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## Single or Multiparameter Instrumentation

Hanna Instruments offers both single parameter and multiparameter instruments in order to meet a variety of testing requirements.

### Using Single Parameter

Hanna single parameter instruments offer simple, accurate and efficient measurement focused on, as the name implies, a single parameter. They are well suited to focused testing where one parameter must be tested quickly and easily. They are generally simple to operate and can be used by non-technical users.

### Using Multiparameter

The advantage of Hanna multiparameter instruments is that a user can choose a single meter with the ability to measure multiple parameters.

Multiparameter instruments offer different operating solutions well suited to meeting multiple requirements and are available in two primary configurations:

1. Multiparameter meters that can measure two or three parameters, but only one parameter at a time.
2. Multiparameter meters that offer two or three parameters measured simultaneously—useful on experimental and research applications where the influence between the parameters is an important factor. Multiple inputs provide the capability for simultaneous measurement.

## pH Measurement Input

Hanna meters generally come in two different electrode connection types: BNC or DIN.

**BNC Connector:** A BNC (Bayonet Neil-Concelman) is a common connector used for coaxial cable devices. A BNC connection is generally used for combined electrodes and half-cell electrodes that require a separate reference probe and separate reference input.

**DIN Connector:** A DIN (Deutsches Institut für Normung) is a circular connector. It is used to connect amplified pH electrodes. Electrodes utilizing a DIN connector feature a built-in temperature sensor.

## Temperature Input

Temperature has an effect on pH measurements. As such, temperature compensation is required for accurate measurements. Temperature compensation can be obtained in three ways:

1. A separate probe specifically for measuring temperature
2. A probe with a temperature sensor built-in.
3. Manual adjustment for temperature

If a temperature input is not present, many instruments still offer the ability to manually adjust the temperature according to an external temperature reference.

## pH Temperature Compensation

pH readings must be temperature compensated in order to obtain accurate results. The source of temperature measurement can be from a temperature sensor or from a trimmer that is manually adjusted. In either case, the instrument is adjusting the pH reading to compensate for changes in the pH sensor. Compensation in pH provides the actual pH at the temperature of measurement.

## mV Reading

Hanna meters with an mV feature offer the ability to read the mV potential from a pH, ORP, or ISE electrode. The relative mV allows the user to offset mV difference generated from sensors or references.

## pH/ISE Calibration

pH calibration should be performed daily or every time a new lot of readings is started. Any errors during calibration will affect all the readings until a new calibration is performed. Errors during the calibration process can be eliminated if standard calibration procedures are followed.

Hanna recommends the following standard calibration procedure:

1. Clean and activate the electrode before the calibration.
2. Use fresh pH buffers and standards.
3. Rinse the electrode with purified water during the calibration process to avoid buffer contamination then a rinse in buffer or standard.
4. Wait for a stable reading before the calibration point is confirmed.
5. Temperature compensation of pH reading and pH buffers.

Calibration is a key component to ensuring accurate readings during pH measurement. With this in mind, Hanna supplies each of our pH instruments with a starter package of calibration solutions.

## pH CAL Check™

Many instruments feature Hanna's exclusive pH CAL Check technology. CAL Check is a diagnostics system that ensures accurate pH readings every time. By alerting users to potential problems during the calibration process, the CAL Check system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions during calibration.

During the calibration process, users are prompted with a step-by-step, on-screen tutorial. After calibration, the electrode is evaluated and the condition and response time is provided. Depending upon meter, this may be a graphic of GLP information.

## Calibration Errors

Instruments utilizing Hanna's CAL Check technology can evaluate an electrode during calibration and store a history of parameters that describe the quality of electrode to be compared from one calibration to another. During calibration, a very small degradation of these parameters is normal and can be expected. A big change in the parameters signifies an error in the calibration procedure, such as a dirty electrode.

## pH Buffer Contamination

pH buffers can be contaminated during the calibration procedure by numerous factors such as introducing a contaminated probe, using old buffers, or by reusing buffers. These factors may cause inaccurate calibration and subsequent measurements.

Hanna's CAL Check can often detect issues during calibration, giving warning messages to inform users about the identified issue.

## Response Time of Electrodes

Another parameter that is evaluated during the calibration with certain meters that have CAL Check technology is the response time of an electrode. This is evaluated based on the amount of time necessary to reach stability when the electrode is immersed in a new buffer that has a difference in pH larger than 3 pH units from the old one.

## Offset and Slope of pH Electrode

The offset and slope are the most important parameters that can describe the quality of an electrode. With Hanna's CAL Check technology, the offset of the electrode can be evaluated using one point calibration. Offset is generally determined using a 7.01 pH buffer, however, using CAL Check allows the offset to be based on any calibration point. The acceptable range for offset is  $\pm 30$  mV although a warning may be displayed.

A minimum of two calibration points is necessary to determine the slope. Slope can be evaluated between two calibration points and normally should fall within a range of 92% to 110%, where 100% is 59.16 mV/pH @ 25°C.

## Calibration Points and pH buffers

The calibration of a pH electrode is normally performed using two points: 7 pH, and 4 or 10 pH. This is based on the assumption that the pH electrode is linear from 3 pH up to 10 pH. For the most accurate reading, Hanna recommends using a calibration point closest to the values received during normal measurement.

For a variety of applications and measuring points, many Hanna meters offer the ability to calibrate using more than two points. Many Hanna instruments offer 2, 3, or up to 5 calibration points for enhanced accuracy. pH buffers 1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01 and 12.45 cover the entire pH range.

During calibration, the recognized pH buffers are temperature compensated by the instrument in order to account for pH variation of buffers due to temperature. For example, a 10.01 pH buffer is 10.01 pH only @ 25°C. A table of temperature variation is printed on the label of each pH buffer.

## Custom pH Buffers

Hanna has implemented the concept of custom pH buffers into many of its instruments. This permits the user to add an industry specific buffer for calibration. However, temperature compensation during calibration is not implemented because the temperature variation correlation is unknown.

## Stability During Calibration

The stability of readings is important in order to avoid incorrect calibration. Based on this, the confirmation of a new calibration point is done only after stability is reached. Users are informed during all processes about the stability conditions, and any instability will restart the stability evaluation. The stability criteria during the calibration is more rigorous than during the measurement. This mode used in Hanna instrumentation avoids errors by confirmation of calibration points during unstable readings. This principle is respected in any type of calibration, manual or automatic.

## Out of Calibration Range

This is an important feature during measurement and is considered Good Laboratory Practice (GLP). The measurement is considered more accurate. If the measurement reading is in a range far from the calibration points, the "out of calibration range" message is displayed. The measured value is shown and the user can accept it, but with the warning from the instrument related to possible inaccuracy.

## Calibration Reminder

The calibration reminder, like "out of calibration range," is a GLP warning message. Regularly scheduled calibrations are crucial for accurate and repeatable measurements. A warning reminder will be displayed when the sensor needs calibration. Measurements can still be used under the warning reminder.

## Step-by-Step Calibration

In order to avoid errors during the calibration procedure, the meters display indicators that can be followed by the user for a successful calibration. If necessary, it is possible for the calibration steps to be performed in a different order by the user.

## Additional Features

GLP and ISO standards require the traceability of operations. Hanna's GLP document the quality of calibration, plus information to identify the instrument, operator, and the time at which calibration was performed.

Logging is a common feature for many instruments and can be used to record readings. Two working modes are available: log-on-demand and automatic or interval logging. With log-on-demand, measurements that are considered important can be saved with the press of the log button. With automatic or interval logging, the instrument saves all the readings according to a specified interval. Another logging mode is Auto-End logging or log on stability.

Many Hanna meters include graphic LCD's with features such as tutorials, contextual help, multi-language support and icons and messages to guide the user through operation and calibration.

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## HALO™ and Hanna Lab App



	pH Range	0.001 pH Resolution	Five-point pH Calibration	Calibration Buffers	GLP features	iPad Compatible	Bluetooth® Wireless Technology	Hanna Lab App Required	Data Logging	Body material	Food Applications	Clogging Prevention	Battery Life	Page
HI11312	0.00-13.00	•	•	up to 7	•	•	•	yes (page 2.20)	•	glass			500 hours	2.16
HI11102	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.20)	•	glass			500 hours	2.17
HI12302	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.20)	•	PEI			500 hours	2.18
FC2022	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.20)	•	PVDF	•		500 hours	2.19
HI10482	0.00-12.00	•	•	up to 7	•	•	•	yes (page 2.20)	•	glass	•	•	500 hours	2.21

## edge®



	Bluetooth® Wireless Technology	Hanna Lab App Compatible	pH Measurement	EC/TDS Measurement	DO Measurement	pH CAL Check™	0.001 pH Resolution	Five-point pH Calibration	Two Custom pH Buffers	GLP Features	Capacitive Touch Buttons	Data Logging	8 Hour Battery Life	PC Connectivity	Benchtop, Portable & Wall-Mount	3.5 mm probe input	Page
edge®blu	•	•	•			•	•	•	•	•	•	•	•	•	•	•	2.8
edge			•	•*	•*	•	•	•	•	•	•	•	•	•	•	•	2.24
edge pH			•			•	•	•	•	•	•	•	•	•	•	•	2.28

\* with optional compatible edge electrode

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## Research Grade pH Benchtop Meters

	Two Channels	ISE Measurement	EC/TDS Measurement	CAL Check™	0.001 pH Resolution	Five-point pH Calibration	Five Custom pH Buffers	GLP Features	Real Time Graphing	Data Logging	Incremental Methods	PC Connectivity	Fully Customizable	Page
HI5222	•	•		•	•	•	•	•	•	•	•	•	•	2.32
HI5221				•	•	•	•	•	•	•		•	•	2.36



pH

## Laboratory Grade pH Benchtop Meters

	mV	CAL Check™	Temperature Measurement	Automatic Calibration	0.001 pH Resolution	Five-point pH Calibration	Two Custom pH Buffers	GLP Features	Data Logging	PC Connectivity	Magnetic Stirrer	Built-in Printer	Built-in Solution Holders	Analog Output	Page
HI122	•	•	•		•	•	•	•		•		•			2.36
HI2221	•	•	•	•		•		•	•	•					2.40
HI2211	•		•	•											2.41
HI2210			•	•											2.41
HI2209	•												•		2.42
HI22091	•												•	•	2.42

comparison guides

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## Waterproof Portable pH Meters



	ISE Measurement	mV Measurement	Temperature Measurement	0.001 pH Resolution	pH Sensor Check™	CAL Check™	Automatic Calibration	Automatic Temperature Compensation	Log on Demand (records)	Two-point pH Calibration	Three-point Calibration	Five-point Calibration	Custom Buffers	Backlit LCD	GLP Features	PC Connectivity	Auto-off	Page
HI98190	•	•	•	•	•	•	•	•	300	•	•	•	•	•	•	•	•	2.44
HI9126	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.43
HI9125	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.68
HI9124	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.68
HI991003	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.69
HI991002	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.69
HI991001	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2.69

## Application Specific Portable Meters

	Temperature Measurement	BEPS	Automatic Temperature Compensation	Two-Point pH Calibration	Waterproof	Soil Measurement	Plating Baths	Boiler & Cooling Towers	Leather & Paper	Foodcare	Milk	Yogurt	Cheese	General Purpose Food	Drinking Water	Beer Analysis	Wine Analysis	Meat Measurement	pH of Skin	Page	
HI98161	•		•	•	•					•										2.48	
HI98162	•		•	•	•						•										2.52
HI98163	•		•	•	•														•		2.56
HI98164	•		•	•	•							•									2.60
HI98165	•		•	•	•								•								2.64
HI99121	•	•	•	•	•	•															2.70
HI99131	•	•	•	•	•		•														2.71
HI99141	•	•	•	•	•			•													2.72
HI99171	•	•	•	•	•				•												2.73
HI99162	•	•	•	•	•						•										2.74
HI99164	•	•	•	•	•							•									2.78
HI99165	•	•	•	•	•								•								2.82
HI99161	•	•	•	•	•									•							2.86
HI99163	•	•	•	•	•														•		2.87
HI99192	•	•	•	•	•										•						2.88
HI99151	•	•	•	•	•											•					2.90
HI99111	•	•	•	•	•												•				2.92
HI99181	•	•	•	•	•														•		2.94



## Other Portable Meters

	mV Measurement	Temperature Measurement	Automatic Calibration	Automatic Temperature Compensation	HOLD Function	Two-Point pH Calibration	Low Battery Indicator	Pre-amplified pH Electrode	Auto-off	Page
HI8424	•	•	•	•	•	•	•		•	2.95
HI8314	•	•		•		•	•	•		2.96
HI83141	•	•		•		•	•			2.96
HI8014	•					•				2.97
HI8010						•				2.97
HI8427	•						•			2.98
HI931001	•									2.98



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## First pH meter in the world with a Bluetooth® Smart pH electrode

Free yourself from wires when performing pH measurements. Hanna Instruments is proud to introduce edge<sup>blu</sup>, a pH meter that uses HALO® pH electrodes with Bluetooth® Smart technology (Bluetooth 4.0). Bluetooth® Smart technology is energy efficient, allowing for low power consumption to maximize the life of the replaceable battery used in the pH electrode.

HALO electrodes can also connect to a compatible smart phone or tablet running the Hanna Lab App.

pH

edge<sup>blu</sup>

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## edge®blu technical features

### Rechargeable Battery

edge blu has a built in rechargeable battery that is charged when the meter is in the plugged in benchtop or wall mount cradle. The battery can also be recharged through the micro USB port with either a USB port from a computer or directly to the power supply.



### Two USB ports

edge blu includes one standard USB for exporting data to a flash drive. edge blu also includes one micro USB port for exporting files to your computer as well as for charging when the cradle is not available.



### Data logging

Log-on-demand, log-on-stability, and interval logging modes are all available. Up to 200 data points can be logged on demand and an additional 200 data points for samples logged upon a stable reading. Interval logging is adjustable from 5 seconds to 180 minutes. Up to 600 records can be stored in a maximum of 100 interval lots. Logging modes can be started from the meter or by simply pressing the button on the HALO pH probe.

### GLP

Data of the last calibration you perform is stored in the sensor including the date, time, and buffers used. When the sensor is connected to edge blu, GLP data is automatically transferred.

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### CAL Check™

Hanna's exclusive CAL Check feature analyzes the pH electrode response in the pH buffers during the calibration process to alert the user of potential problems such as a contaminated buffer or dirty electrode. After calibration, indicators for probe condition are displayed on the measurement screen. The probe condition is based on offset and slope characteristics of the pH electrode.



### Bluetooth Smart Technology

HI11102 HALO® pH electrode uses Bluetooth® Smart Technology (Bluetooth 4.0). This technology offers low power consumption allowing for a long 500 hour battery life. The range of the Bluetooth connection is 10 m (33') between the probe and receiving device.



### Auto-detection

At a push of the button, the HALO pH electrode enters discovery mode and will be detected by edge blu. Once connected, the serial number, calibration information including date, time and buffers used, and the electrode specifications will be loaded into the meter. Having this information stored in the electrode allows for hot swapping to other pH electrodes without recalibrating. The details of the electrode and calibration information are stored with any logged readings.

## edge blu design features



### Capacitive touch keypad

edge blu features sensitive capacitive touch buttons for accurate keystrokes when navigating edge's menus and screens. Since they are part of the screen, the buttons can never get clogged with sample residue.



### Easy to read LCD

edge blu features a 5.5" (14 cm) LCD display that you can clearly view from over 5 m (16.4'). The large display, with its wide 150° viewing angle, provides one of the easiest to read LCDs in the industry.



### Zero footprint

Using the wall mount cradle (included), edge blu can be placed on a wall, leaving zero footprint on the benchtop space. The cradle has a built-in connector to power and charge the batteries.

The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc.





## A hybrid meter that can be used in portable, wall-mount, and benchtop configurations

The versatile design of edge®blu enables it to be used as a portable, wall-mount, or benchtop meter. edge blu simplifies measurement, wirelessly using compatible HALO® pH electrodes with Bluetooth® Smart technology.



### Portable field unit

edge blu is ideal for field use due to its light weight, large screen, and thin design. It can easily be slipped into a backpack or messenger bag. The battery life lasts up to 8 hours when used as a portable device.



### Wall-mount cradle

The included wall-mount cradle makes it easy to conserve space on the benchtop while also charging edge blu with the AC adapter. The cradle is ideal for continuous monitoring applications.



### Electrode holder with built-in cradle

The electrode holder features a swivel, adjustable arm with a built-in cradle to hold edge blu securely in place at the optimum viewing angle.

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HI181 magnetic stirrer and beaker not included.

4.0

Bluetooth®  
Smart

0

footprint

0.5

inch thick  
(12.7 mm)

8.8

oz. weight  
(250 g)

8

hours battery  
life

5.5

inch display  
(14 cm)

2

USB ports

## edge blu additional features

- Resolution selectable from 0.01 and 0.001 pH
- Range -2.000 to 16.000 pH
- Accuracy  $\pm 0.002$  pH for 0.001 pH resolution;  $\pm 0.01$  for 0.01 resolution
- Data logging
  - Manual log-on-demand
  - Manual log-on-stability
  - Interval logging
- Temperature readout ( $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ )
- Automatic Temperature Compensation (ATC)
- CAL Check Indicators:
  - Probe condition
  - Response time
  - Check buffer
  - Clean electrode
- GLP data
  - Records date, time, offset, slope, and buffers used during calibration
- Five-point calibration
  - A choice of seven pre-programmed buffers plus two custom buffers
- Calibration tag on screen
  - Identifies buffers used for current calibration
- Calibration expiration warning
- Basic mode
  - You can use edge®blu Basic Mode—ideal for routine measurements by displaying a simplified screen and features
- Standby mode
  - HALO® can be switched between standby and measurement mode by edge blu. When measurement is resumed, HALO is automatically recognized. Standby mode is ideal for applications such as aquariums when only periodic measurements are needed in the same sample.

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## HI11102 HALO pH electrode with Bluetooth® Smart technology

edge blu® is supplied with the HI11102 HALO® professional pH probe with Bluetooth® Smart technology (Bluetooth 4.0). This probe is compatible with the edge blu and the Hanna Lab App<sup>1</sup>.

The HI11102 HALO pH electrode is a glass body, gel filled, double junction pH electrode that has an indicating probe made with general purpose glass. The glass body is resistant to many chemicals and easy to clean. Being gel filled reduces maintenance since there are no fill solutions to add. The double junction design is suitable for a variety of solutions that can contain substances such as heavy metals or Tris buffer that will cause the silver chloride (AgCl) found in a single junction probe to precipitate and clog the junction.

- Gel filled glass pH electrode
- Double junction reference design
- Integrated temperature sensor
  - Ensures calibration and measurement is automatically temperature compensated, thus eliminating error
- Wide pH (0 to 12) and temperature (-5 to 80°C) range
- Clear the clutter
  - Data is wirelessly transmitted to the edge blu or compatible smart phone or tablet running the Hanna Lab App via Bluetooth® Smart technology<sup>1</sup>. HI11102 HALO provides up to 500 hours of battery life
- Calibration is stored
  - HI11102 HALO stores calibration information; no additional calibration is needed when switching to another edge blu or iPad
- Battery condition
  - The measurement screen of the edge blu and Hanna Lab App displays the name, battery life and condition of the HI11102 HALO probe

## Hanna Lab App

pH Meter Application for use with HALO



The Hanna Lab App turns compatible smart phone or tablet into a full-featured pH meter when used with a HALO pH probe via Bluetooth® Smart technology. Functions include calibration, measurement, data logging, graphing, and data sharing. Measurement and logging of pH and temperature at one second intervals start as soon as the probe is connected. Measurements can be displayed alone on the display, with tabulated data or as a graph. The graph can be panned and zoomed with pinch-to-zoom technology for enhanced viewing.



- Connects via Bluetooth® 4.0
- Calibration reminder
- Real-time data
  - Displays updated pH and temperature updated every second
- Measurement alarms
  - Alerts users if the measurement threshold is exceeded
- Basic GLP
  - Displays date and time of current calibration along with probe offset and average slope
- Full GLP
  - Displays date and time of current calibration, probe offset, and average slope along with calibrated buffers, mV values, temperature and slopes between each buffer
- Fluid, dynamic graphing
  - Measurement can be displayed with tabulated data or as a graph
- One button sample tagging
- Data-logging with custom annotations
  - Data is automatically saved every hour
  - Saved log files may be annotated with measurement specific information
- Four ways to save and share data:
  - All data since last auto save
  - Annotations only
  - All data within a timed interval
  - Annotations within a timed interval
- Share data via email in CSV format
- Help and tutorials

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<sup>1</sup> HALO electrodes can only be used with one compatible device at a time.

Specifications	edge®blu*	
pH	Range <sup>2</sup>	-2.00 to 16.00 pH; -2.000 to 16.000 pH <sup>†</sup>
	Resolution	0.01 pH; 0.001 pH <sup>†</sup>
	Accuracy (@25°C/77°F)	±0.01 pH; ±0.002 pH <sup>†</sup>
	Calibration	Basic mode: Automatic, up to 3 points calibration 5 standard buffer Standard mode: Automatic up to 5 points calibration 7 standard buffers (1.68, 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45) and 2 custom buffers <sup>†</sup>
	Temperature Compensation <sup>2</sup>	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using integral temperature sensor)
	Electrode Diagnostics	standard mode: probe condition, response time, and out of calibration range
mV pH	Range	±1000 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±0.2 mV
Temperature	Range <sup>2</sup>	-20.0 to 120.0°C; -4.0 to 248.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C; ±0.9°F
Additional Specifications	Probe	HI11102 HALO® glass body pH electrode with Bluetooth® Smart technology
	Logging	up to 1000 <sup>†</sup> (400 for basic mode) records organized in: manual log-on-demand (max. 200 logs), manual log-on-stability (max. 200 logs), interval logging <sup>†</sup> (max. 600 samples; 100 lots)
	Connectivity	1 USB port for storage; 1 micro USB port for charging and PC connectivity
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Power Supply	5 VDC adapter (included)
	Dimensions	202 x 140 x 12 mm (7.9" x 5.5" x 0.5")
	Weight	250 g (8.82 oz.)
Ordering Information	<b>HI2202-01</b> (115V) and <b>HI2202-02</b> (230V) edge blu includes: HI11102 HALO pH electrode with Bluetooth® Smart technology, pH 4 buffer solution sachets (4), pH 7 buffer solution sachets (2), pH 10 buffer solution sachets (2), electrode cleaning solution sachets (2), battery for HALO, benchtop docking station with electrode holder, wall-mount cradle, USB cable, 5 VDC power adapter, quality certificates and instruction manual.	

HALO Specifications	HI11102 HALO (included)
Reference	double, Ag/AgCl
Junction	ceramic
Electrolyte	gel
Range	0.00 to 12.00 pH ±420 mV
Bulb Shape	spheric
Outer Diameter (glass)	12 mm (glass)
Overall Length	183 mm
Solution Temperature	-5.0 to 80.0°C (23.0 to 176.0°F)
Body Material	glass
Environment	0.0 to 50.0°C (32.0 to 122.0°F), electronic module is not waterproof
Temperature Sensor	integrated
Connection	Bluetooth® Smart (Bluetooth® 4.0), 10 m (33') range
Battery Type / Life	CR2032 3V lithium ion / approximately 500 hours

#### Hanna Lab App Specifications\*

Range <sup>2</sup>	-2.000 to 16.000 pH ±800 mV -20.0 to 120.0°C (-4.0 to 248.0°F)
Resolution	0.1; 0.01; 0.001 pH 1; 0.1 mV 0.1°C (0.1°F)
Accuracy (@25°C/77°F)	±0.005 pH ±0.3 mV ±0.5°C (±1.0°F)
Calibration Points	up to five-point calibration with seven standard buffers (1.68, 3.00 or 4.01, 6.86, 7.01, 9.18, 10.01, 12.45 pH)
Temperature Compensation <sup>2</sup>	automatic from -5.0 to 100.0°C; 23.0 to 212.0°F
Compatibility/System Requirements	see www.hannainst.com for latest compatibility requirements

Download Information



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<sup>2</sup> Limits will be reduced to actual probe/sensor limits.

\* HALO required for measurement use.

<sup>†</sup> Standard mode only

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Connect to the  
Hanna Lab App

Compatible smart phone or tablet  
not included.



Electrode holder, beaker and magnetic stirrer not included.

## The world's first pH electrode with Bluetooth® Smart technology

HALO® is the world's first professional pH probe with Bluetooth® Smart technology (Bluetooth® 4.0). This technology is energy efficient, allowing for low power consumption to maximize the life of the replaceable battery used in the pH electrode. HALO pH probes feature a built-in temperature sensor and can be used virtually anywhere: in the field, laboratory, or classroom. Their versatility and ease of use will revolutionize the way pH is measured.

### HALO Features

- Models for lab, field, and food applications
- Double junction reference design
- Integrated temperature sensor
  - Ensures calibration and measurement are automatically temperature compensated, eliminating error from fluctuations
- Wide pH and temperature range (model dependent)
- Clear the clutter
  - Data is wirelessly transmitted to a compatible smart phone or tablet running the Hanna Lab App
- One button sample tagging
  - Pressing the button on the HALO pH probe or the probe icon in the Hanna Lab App will tag sample data for easy reference
- Stored calibration
  - HALO stores calibration information; no additional calibration is needed when switching to another device
- Battery condition
  - The measurement screen of the Hanna Lab App displays the name, battery life, and condition of the HALO probe



### One press connect

Connect to the Hanna Lab App at the press of a button via Bluetooth® wireless technology (10 m range (33')).



### Status indicator

Visible from a distance, the LED halo light indicates the probe is active and transmitting.



### Easy to replace battery

The HALO's CR2032 lithium ion battery is easily replaced and lasts for approximately 500 hours.

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HI11312

# HALO®

Compatible with:  
iOS  
Android™  
edge blu

The HI11312 HALO® is a revolutionary refillable pH electrode that incorporates Bluetooth Smart (Bluetooth 4.0) wireless technology with an application-specific design. This electrode has many features that makes it ideal for use in a wide variety of applications. These features include general purpose (GP) glass, spheric bulb, integrated temperature sensor, glass body, and double reference junction with silver-free electrolyte. All readings are transmitted directly to a compatible smart phone or tablet running the Hanna Lab App or edge®blu.

## General Purpose Glass Formulation

General Purpose (GP) glass, as the name implies, is a standard glass formulation that is used for general use. A pH electrode with GP glass will have a resistance of 100 megaohms at 25°C and is suited for measuring pH of samples that are at ambient temperatures. The HI11312 is suitable to use with samples that measure from -5 to 80°C (23 to 176°F).

## Spheric Glass Bulb

The spheric bulb is for general purpose use within laboratory environments and applications that measure aqueous solutions due to its large surface area. Other tip shapes include conic for penetration and flat tip for surface measurements.

## Built-in Temperature Sensor

HI11312 features a built-in thermistor temperature sensor that is in the tip of the indicating pH electrode. A thermistor temperature sensor provides for a high accuracy temperature reading and should be as close as possible to the indicating pH electrode in order to compensate for the effect that temperature has on the membrane potential as predicted by the Nernst equation. By having an accurate reading it is possible to provide a temperature compensated reading.

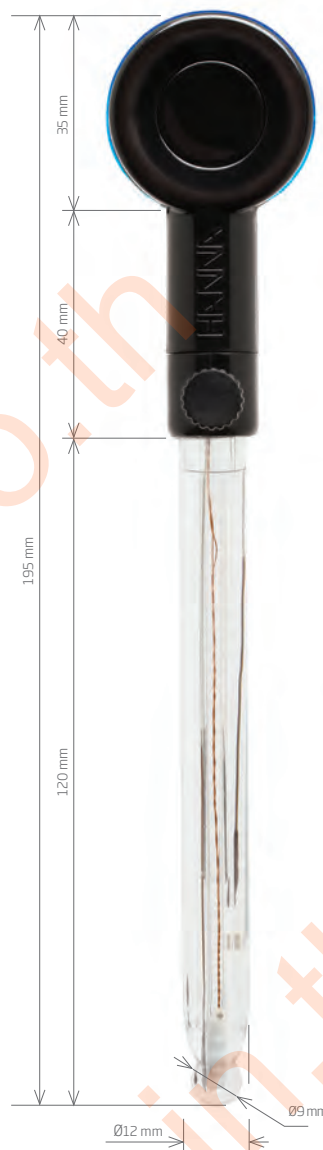
## Glass Body

The glass body of the HI11312 is ideal for laboratory use and measurement of grab samples. The glass is resistant to many harsh chemicals and is easy to clean. The glass body also allows for a fast transfer of heat to the internal reference electrolyte. The mV generated by the reference cell is temperature dependent, so the faster thermal equilibrium is reached, the steadier the reference potential.

## Single Ceramic Double Junction Reference

The HI11312 is a double junction design. The junction also known as a salt bridge is necessary component of the electrical circuit. The movement of ions must flow through the junction for a steady reading. The outer reference has a single ceramic frit. The ceramic is a porous material that is easily fused with the glass body and has a similar expansion coefficient. A single ceramic junction allows the 3.5M KCl electrolyte to flow at a rate of 15 to 20 µL/hour.

The double junction design ensures that the KCl electrolyte is free of silver chloride (AgCl) between the sample to be measured and the internal reference cell, resisting clogging and any potential precipitation at the junction.



## HALO Specifications

## HI11312

Reference	double, Ag/AgCl
Junction	ceramic
Electrolyte	3.5M KCl
Range	0.00 to 13.00 pH ±420 mV -5.0 to 80.0°C (23.0 to 176.0°F)
Bulb Shape	spherical
Outer Diameter (glass)	12 mm (glass)
Overall Length	195 mm
Solution Temperature	-5.0 to 80.0°C (23.0 to 176.0°F)
Environment	0.0 to 50.0°C (32.0 to 122.0°F), electronic module is not waterproof
Temperature Sensor	integrated
Body Material	glass
Connection	Bluetooth® Smart (Bluetooth® 4.0), 10 m (33') range
Battery Type / Life	CR2032 3V lithium ion / approximately 500 hours

## Ordering Information

**HI11312** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, fill solution, battery, quality certificate and instruction sheet.

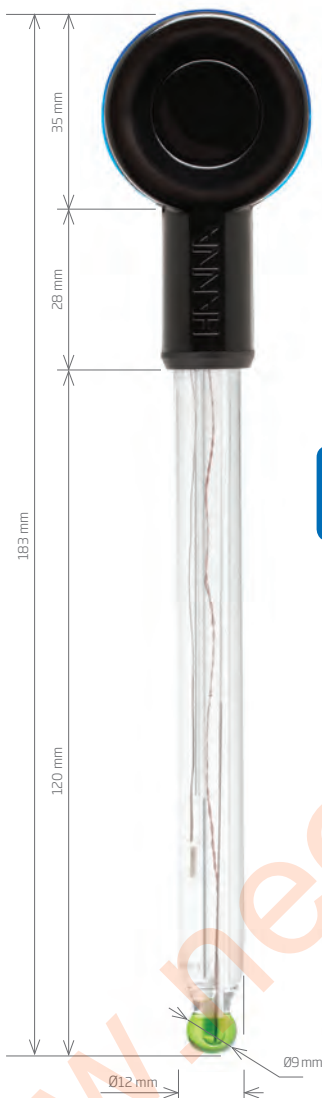
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Included with  
edge@blu

HI11102

**HALO**®

Compatible with:  
iOS  
Android™  
edge blu

2

The HI11102 HALO® is a revolutionary pH electrode that incorporates Bluetooth Smart (Bluetooth 4.0) wireless technology with an application specific design. This electrode has many features that makes it ideal for laboratory use. These features include general purpose (GP) glass, spheric bulb, integrated temperature sensor, glass body, and double reference junction with silver-free gel electrolyte. All readings are transmitted directly to a compatible smart phone or tablet running the Hanna Lab App or edge blu.

### General Purpose Glass Formulation

General Purpose (GP) glass, as the name implies, is a standard glass formulation that is used for general use. A pH electrode with GP glass will have a resistance of 100 megaohms at 25°C and is suited for measuring pH of samples that are at ambient temperatures. The HI11102 is suitable to use with samples that measure from -5 to 80°C (23 to 176°F).

### Spheric Glass Tip

The spheric bulb is for general purpose use within laboratory environments and applications that measure aqueous solutions due to its large surface area. Other tip shapes include conic for penetration and flat tip for surface measurements.

### Built-in Temperature Sensor

HI11102 features a built-in thermistor temperature sensor that is in the tip of the indicating pH electrode. A thermistor temperature sensor provides for a high accuracy temperature reading and should be as close as possible to the indicating pH electrode in order to compensate for the effect that temperature has on the membrane potential as predicted by the Nernst equation. By having an accurate reading it is possible to provide a temperature compensated reading.

### Glass Body

The glass body of the HI11102 is ideal for laboratory use. The glass is resistant to many harsh chemicals and is easy to clean. The glass body also allows for a fast transfer of heat to the internal reference electrolyte. The mV generated by the reference cell is temperature dependent, so the faster thermal equilibrium is reached, the steadier the reference potential.

### Single Ceramic Double Junction Reference

The HI11102 is a double junction design. pH electrodes are available as single junction or double junction. The junction also known as a salt bridge is necessary component of the electrical circuit. The movement of ions must flow through the junction for a steady reading. The outer reference has a single ceramic frit. The ceramic is a porous material that is easily fused with the glass body and has a similar expansion coefficient. A single ceramic junction allows the gel electrolyte to flow at a rate of 15-20 µL/hour.

The double junction design ensures that the gel electrolyte is free of silver chloride (AgCl) between the sample to be measured and the internal reference cell, resisting clogging and any potential precipitation at the junction.

#### HALO Specifications

#### HI11102

Reference	double, Ag/AgCl
Junction	ceramic
Electrolyte	gel
Range	0.00 to 12.00 pH ±420 mV -5.0 to 80.0°C (23.0 to 176.0°F)
Bulb Shape	spherical
Outer Diameter (glass)	12 mm (glass)
Overall Length	183 mm
Solution Temperature	-5.0 to 80.0°C (23.0 to 176.0°F)
Environment	0.0 to 50.0°C (32.0 to 122.0°F), electronic module is not waterproof
Temperature Sensor	integrated
Body Material	glass
Connection	Bluetooth® Smart (Bluetooth® 4.0), 10 m (33') range
Battery Type / Life	CR2032 3V lithium ion / approximately 500 hours

#### Ordering Information

**HI11102** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, fill solution, battery, quality certificate and instruction sheet.

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pH solutions begin on page 2.136

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**HANNA**  
instruments

pH

HALO

2.17



HI12302

# HALO®

Compatible with:  
iOS  
Android™  
edge blu

The HI12302 HALO is a revolutionary pH electrode that incorporates Bluetooth Smart (Bluetooth 4.0) wireless technology with an application-specific design. This electrode has many features that makes it ideal for use in the field or on the production floor. These features include general purpose (GP) glass, spheric bulb, integrated temperature sensor, PEI body, and double reference junction with silver-free gel electrolyte. All readings are transmitted directly to a compatible smart phone or tablet running the Hanna Lab App or edge®blu.

## General Purpose Glass Formulation

General Purpose (GP) glass, as the name implies, is a standard glass formulation that is used for general use. A pH electrode with GP glass will have a resistance of 100 megaohms at 25°C and is suited for measuring pH of samples that are at ambient temperatures. The HI12302 is suitable to use with samples that measure from -5 to 70°C (23 to 158°F).

## Spheric Glass Bulb

The spheric bulb is for general purpose use within laboratory environments and applications that measure aqueous solutions due to its large surface area. Other tip shapes include conic for penetration and flat tip for surface measurements.

## Built-in Temperature Sensor

HI12302 features a built-in thermistor temperature sensor that is in the tip of the indicating pH electrode. A thermistor temperature sensor provides for a high accuracy temperature reading and should be as close as possible to the indicating pH electrode in order to compensate for the effect that temperature has on the membrane potential as predicted by the Nernst equation. By having an accurate reading it is possible to provide a temperature compensated reading.

## PEI Body

The body of the HI12302 is composed of polyetherimide (PEI) resin. PEI is suitable for a wide range of applications and excels in field measurements due to its durability. The shielding around the spherical glass tip minimizes breakage due to accidental bumping or dropping of the electrode. PEI is a high quality plastic that is chemically resistant to many aggressive chemicals.

## Single Ceramic Double Junction Reference

The HI12302 is a double junction design. pH electrodes are available as single junction or double junction. The junction also known as a salt bridge is necessary component of the electrical circuit. The movement of ions must flow through the junction for a steady reading. The outer portion of the reference cell has a single ceramic frit. A single ceramic junction allows the gel electrolyte to flow at a rate of 15 to 20 µL/hour.

The double junction design ensures that the gel electrolyte is free of silver chloride (AgCl) between the sample to be measured and the internal reference cell, resisting clogging and any potential precipitation at the junction.

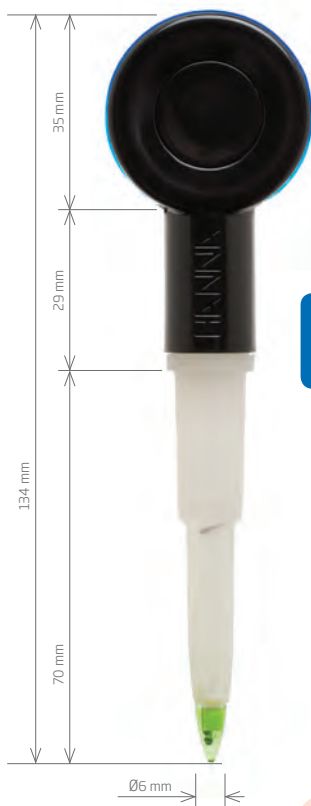
HALO Specifications	HI12302
Reference	double, Ag/AgCl
Junction	ceramic
Electrolyte	gel
Range	0.00 to 12.00 pH ±420 mV -5.0 to 70.0°C (23.0 to 158.0°F)
Bulb Shape	dome
Outer Diameter (glass)	12 mm (plastic)
Overall Length	165 mm
Solution Temperature	-5.0 to 70.0°C (23.0 to 158.0°F)
Environment	0.0 to 50.0°C (32.0 to 122.0°F), electronic module is not waterproof
Temperature Sensor	integrated
Body Material	PEI
Connection	Bluetooth® Smart (Bluetooth® 4.0), 10 m (33') range
Battery Type / Life	CR2032 3V lithium ion / approximately 500 hours
Ordering Information	HI12302 (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, fill solution, battery, quality certificate and instruction sheet.

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Ideal for food applications

FC2022

**HALO**

Compatible with:  
iOS  
Android™  
edge blu

2

The FC2022 is revolutionary pH electrode that incorporates Bluetooth Smart (Bluetooth 4.0) wireless technology with an application specific design. This electrode has many features that makes it ideal for measuring food related products. These features include: low temperature (LT) glass, conical bulb, food grade PVDF body, and open junction with viscolene gel electrolyte. All readings are transmitted directly to a compatible smart phone or tablet running the Hanna Lab App or edge®blu.

### Low Temperature Glass Formulation

The glass tip uses a special Low Temperature (LT) glass formulation with a lower resistance of approximately 50 megohms compared to General Purpose (GP) with a resistance of about 100 megohms. This is beneficial since many food products are stored at low temperatures. As the temperature of the glass decreases in the sample, the resistance of the LT glass will increase approaching that of GP glass at ambient temperatures. If using GP glass, the resistance would increase above the optimum resistance for the high impedance input of a pH meter. The FC2022 is suitable to use with samples that measure from 0 to 60°C.

### Conic Glass Tip

The conical shaped tip design allows for penetration into solids, semi solids, and emulsions for the direct measurement of pH in food products including meat, cheese, yogurt, and milk.

### Built-in Temperature Sensor

FC2022 features a built-in thermistor temperature sensor that is in the tip of the indicating pH electrode. A thermistor temperature sensor provides for a high accuracy temperature reading and should be as close as possible to the indicating pH electrode in order to compensate for the effect that temperature has on the membrane potential as predicted by the Nernst equation. By having an accurate reading it is possible to provide a temperature compensated reading.

### PVDF Body

Polyvinylidene fluoride (PVDF) is a food grade plastic that is resistant to most chemicals and solvents, including sodium hypochlorite. It has high abrasion resistance, mechanical strength and resistance to ultraviolet and nuclear radiation. PVDF is also resistant to fungal growth.

### Open Junction Reference

This electrode has a unique open junction design in which there is a viscolene (hard gel) electrolyte layer that is free of silver chloride (AgCl) between the sample to be measured and the internal reference cell. The open junction design resists clogging and the probe's conical tip makes it ideal for pH measurements in food products including dairy, dough, ground meats and other semi-solid food samples.

#### HALO Specifications

#### FC2022

Reference	double, Ag/AgCl
Junction	open junction
Electrolyte	viscolene
Range	0.00 to 12.00 pH ±420 mV 0.0 to 60.0°C (32.0 to 140.0°F)
Bulb Shape	conical
Outer Diameter (glass)	12 mm to 8 mm taper (plastic)
Overall Length	134 mm
Solution Temperature	0.0 to 60.0°C (32.0 to 140.0°F)
Environment	0.0 to 50.0°C (32.0 to 122.0°F), electronic module is not waterproof
Temperature Sensor	integrated
Body Material	PVDF
Connection	Bluetooth® Smart (Bluetooth® 4.0), 10 m (33') range
Battery Type / Life	CR2032 3V lithium ion / approximately 500 hours

#### Ordering Information

**FC2022** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, fill solution, battery, quality certificate and instruction sheet.

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pH solutions begin on page 2.136

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pH

HALO

2.19

## The Importance of pH in Wine Making

The pH of wine is important to determine because it will affect the quality of the final product in terms of taste, color, oxidation, chemical stability and other factors. Generally in winemaking, the higher the pH reading, the lower amount of acidity in the wine. Three important factors in determining the pH of wine include the ratio of malic acid to tartaric acid, the amount of potassium, and the total amount of acid present.

Most wines optimally have a pH between 2.9 and 4.0, with values differing based on the type of wine. Values above pH 4.0 indicate that the wine may spoil quickly and be chemically unstable. Lower pH values allow the wine to stay fresher for a longer period and retain its original color and flavor. High pH wine is more likely to breed bacteria and become unsuitable to drink. For finished white wines, the ideal pH is between pH 3.00 and pH 3.30, while the final pH for red wine is ideally between pH 3.40 and pH 3.50. The optimal pH before the fermentation process is between pH 2.9 and pH 4.0. The pH of wine therefore not only affects the color of wine, but also the oxidation, yeast fermentation, protein stability and bacteria growth and fermentation.



Ideal for wine  
must and juice

CPS™  
(Clogging  
Prevention  
System)

HI10482

# HALO®

Compatible with:  
iOS  
Android™  
edge blu

The HI10482 HALO is a Bluetooth Smart (Bluetooth 4.0) pH and temperature electrode with Hanna's Clogging Prevention System (CPS).

This refillable electrode has a unique ground glass junction coupled with a PTFE sleeve to prevent particulates within a sample from clogging the junction. In addition, the glass body of the HI10482 and spherical sensing bulb make it ideal for use in a wide variety of applications. All readings are transmitted directly to the HI2202 edge®blu or a compatible smart phone or tablet running the Hanna Lab App.

The calibration features of the HI10482 HALO electrode are of great benefit to winemakers. Generally, a pH between 2.9 and 4.0 is optimal for most wines. To increase accuracy and ensure the expected readings are bracketed between the calibration points, pH 3.00 calibration buffer is displayed in lieu of pH 4.01 buffer when this application-specific HALO is connected to the Hanna Lab App or edge®blu.

## General Purpose Glass Formulation

General Purpose (GP) glass, as the name implies, is a standard glass formulation that is used for general use. A pH electrode with GP glass will have a resistance of 100 megaohms at 25°C and is suited for measuring pH of samples that are at ambient temperatures. The HI10482 is suitable to use with samples that measure from 0 to 80°C (32 to 176°F).

## Dome Shaped Glass Bulb

The dome shaped bulb is for general purpose use within laboratory environments and applications that measure aqueous solutions due to its large surface area.

## CPS Sleeve Junction

Clogging Prevention System (CPS) technology is an innovation for the improvement of pH measurements in samples that have a high solids content. Conventional pH electrodes use ceramic junctions that can clog quickly when used in samples that have a high solids content such as wine, must, or juice. When the junction is clogged, the electrode does not function. The CPS technology utilizes the porousness of ground glass coupled with a PTFE sleeve to prevent clogging of the junction. The ground glass allows proper flow of the liquid, while the PTFE sleeve repels solids. As a result, pH electrodes with CPS technology take up to 20 times longer to be fouled as compared to conventional electrodes.

## Built-In Temperature Sensor

HI10482 features a built-in thermistor temperature sensor that is in the tip of the indicating pH electrode. A thermistor temperature sensor provides for a high accuracy temperature reading and should be as close as possible to the indicating pH electrode in order to compensate for the effect that temperature has on the membrane potential as predicted by the Nernst equation. By having an accurate reading it is possible to provide a temperature compensated reading.

## Glass Electrode Body

The glass body of the HI10482 is ideal for laboratory use. The glass is resistant to many harsh chemicals and is easy to clean. The glass body also allows for a fast transfer of heat to the internal reference electrolyte. The mV generated by the reference cell is temperature dependent, so the faster thermal equilibrium is reached, the steadier the reference potential.

### HALO Specifications

### HI10482

Reference	double, Ag/AgCl
Junction	open, CPS™ technology
Electrolyte	3.5M KCl
Range	0.00 to 12.00 pH ±420 mV 0.0 to 80.0°C (32.0 to 176.0°F)
Bulb Shape	dome
Outer Diameter (glass)	8 mm
Overall Length	195 mm
Solution Temperature	0.0 to 80.0°C (32.0 to 176.0°F)
Environment	0.0 to 50.0°C (32.0 to 122.0°F), electronic module is not waterproof
Temperature Sensor	integrated
Body Material	glass
Connection	Bluetooth® Smart (Bluetooth® 4.0), 10 m (33') range
Battery Type / Life	CR2032 3V lithium ion / approximately 500 hours

### Ordering Information

**HI10482** (HALO) is supplied with storage solution, cleaning solution, pH 7.01 buffer solution, pH 4.01 buffer solution, fill solution, battery, quality certificate and instruction sheet.

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## Hanna Lab App

pH Meter Application for use with HALO®



Smart device not included.

## Hanna Lab App – Available on iOS and Android

Connecting a HALO probe to the Hanna Lab App is simple. Measurement and logging of pH and temperature at one second intervals start as soon as the probe is connected.

- Connects HALO to a smart device via Bluetooth® 4.0
- Up to five-point pH calibration with seven standard preprogrammed pH buffers
- Calibration reminder
  - Alerts users when HALO needs calibration
- Real-time data
  - Displays updated pH and temperature every second
- Basic GLP
  - Displays date and time of current calibration along with probe offset and average slope
- Full GLP
  - Displays date and time of current calibration, probe offset, and average slope along with calibrated buffers, mV values, temperature and slopes between each buffer
- Fluid, dynamic graphing
  - Measurement can be displayed with tabulated data or as a graph. The graph axes may be expanded using pinch-to-zoom technology for enhanced viewing
- Measurement alarms
  - Alerts users if the measurement threshold is exceeded
- One button sample tagging
  - Pressing the button on the HALO pH probe or the probe icon in the Hanna Lab App will tag sample data for easy reference
- Data-logging with custom annotations
  - Saved log files may be annotated with measurement specific information
  - Data is automatically saved every hour
- Share data via email in CSV format
- Four ways to save and share data:
  - All data since last auto save
  - Annotations only
  - All data within a timed interval
  - Annotations within a timed interval
- Help and tutorials:
  - Demo probe mode
  - General app information
  - General HALO information
  - pH tutorial
  - Maintenance tutorial
  - Contact information

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# The first app that turns a smart phone or tablet into a full-featured pH meter

## Screen features

The Hanna Lab App turns a compatible smart phone or tablet into a full-featured pH meter when used with a HALO® pH probe with Bluetooth® Smart technology. Functions include calibration, measurement, data logging, graphing, and data sharing. Measurement and logging of pH and temperature at one second intervals start as soon as the probe is connected. Measurements can be displayed alone on the display, with tabulated data or as a graph. The graph can be panned and zoomed with pinch-to-zoom technology for enhanced viewing.

### Connectivity

Connecting a HALO probe to the Hanna Lab App is simple. With a press of the HALO button, a compatible device can quickly discover and connect to the probe. Readings of pH and temperature automatically begin logging at one second intervals once the HALO is paired with your edge blu, Android or iOS device.

### Calibration and Measurement

The Hanna Lab App allows for calibration of up to five points. The buffer value is automatically detected and temperature corrected to 25.0°C during calibration.

Readings that exceed user-defined alarm thresholds are highlighted in yellow on the measurement screen, graph, and table. Readings that exceed the probe specifications are highlighted in red.

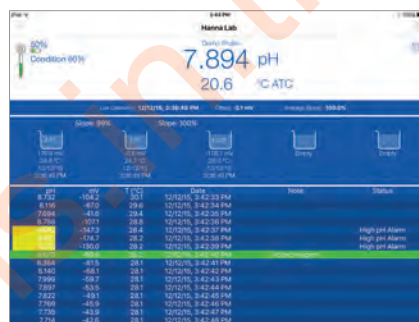
Readings are automatically saved to a history file every hour, limited only by the available memory on the host device. Readings in specific time intervals can also be saved. Saved log files may be annotated with measurement-specific information and also shared via email in CSV format.



Easily accessible help menu



Clear and concise calibration screens



HALO continuously logs measurements and lets you retrieve the data you want, when you need it



Share data complete with custom annotations via email



### Settings

Tap the gear icon in the top right corner of the measurement screen to access the Probe Settings menu for the following options:

- **Measurement**
  - Mode: pH or mV
  - Resolution
  - Temperature compensation: automatic or manual
  - Temperature units
- **Calibration**
  - Perform calibration
  - Calibration buffers: Hanna or NIST
  - Calibration reminder
- **Logging**
  - Clear, save or share
- **Alarms**
  - pH (mV) and temperature
- **Display**
  - Good Laboratory Practice (GLP): on-screen calibration data
  - View: basic, graph, or table
  - Graph display: pH (mV) and/or temperature
  - Stability criteria

#### Hanna Lab App Specifications\*

Range**	-2.000 to 16.000 pH ±800 mV -20.0 to 120.0°C (-4.0 to 248.0°F)
Resolution	0.1; 0.01; 0.001 pH 1; 0.1 mV 0.1°C (0.1°F)
Accuracy (@25°C/77°F)	±0.005 pH ±0.3 mV ±0.5°C (±1.0°F)
Calibration Points	up to five-point calibration with seven standard buffers (1.68, 3.00 or 4.01, 6.86, 7.01, 9.18, 10.01, 12.45 pH)
Temperature Compensation**	automatic from -5.0 to 100.0°C; 23.0 to 212.0 °F
Compatibility/System Requirements	see <a href="http://www.hannainst.com">www.hannainst.com</a> for latest compatibility requirements

[Download Information](#)



\*HALO required for measurement use. \*\* Limits will be reduced to actual probe/sensor limits.

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## The world's most innovative pH, EC and DO meter

edge's groundbreaking design is the culmination of Hanna's vision, design capabilities, integrated production and world class R&D. The edge is rich in features to accommodate the needs of a vast amount of customers. For those that prefer very simplistic operation there is a basic mode operation with simplified menu and options while for those who require advanced features there is the full featured standard operating mode. edge is available as a pH, conductivity or dissolved oxygen kit and any edge kit can be upgraded with additional probes to measure pH, conductivity and dissolved oxygen.



## edge® technical features

### Rechargeable Battery

edge has a built in rechargeable battery that is charged when the meter is in the plugged in benchtop or wall mount cradle. The battery can also be recharged through the micro USB port with either a USB port from a computer or directly to the power supply.



### Two USB ports

edge includes one standard USB for exporting data to a flash drive. edge also includes one micro USB port for exporting files to your computer as well as for charging when the cradle is not available.



### Clear, full text readout

edge features clear, full text guides displayed on the bottom of the screen. There is no need to decipher scrambled abbreviations or symbols; these helpful messages guide you through every process quickly and easily.



### Data logging

edge allows you to store up to 1000 log records of data. Data sets include readings, GLP data, date and time.

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### GLP

Data of the last calibration you perform is stored in the sensor including the date, time, and buffers used. When the sensor is connected to edge, GLP data is automatically transferred.

### Two Operating Modes

edge can be used in Extended or Basic Operating Modes. Extended Mode enables all edge features while Basic Mode reduces features—ideal for routine measurements by displaying a simplified screen and features.



### CAL Check™

Hanna's exclusive CAL Check feature analyzes the pH electrode response in the pH buffers during the calibration process to alert the user of potential problems such as a contaminated buffer or dirty electrode. After calibration, indicators for probe condition are displayed on the measurement screen. The probe condition is based on offset and slope characteristics of the pH electrode.

### Sensor Check™ (pH only)

When used with Hanna's electrodes equipped with a matching pin, edge constantly checks the impedance of the pH measuring electrode to notify you in real time in the event of glass breakage. During calibration, Sensor Check checks the state of the junction. The reference junction is also evaluated and reported on the display.

### ORP Measurement

edge measures ORP with edge compatible ORP probes.

## edge design features



### Capacitive touch keypad

edge features sensitive capacitive touch buttons for accurate keystrokes when navigating edge's menus and screens. Since they are part of the screen, the buttons can never get clogged with sample residue.



### Easy to read LCD

edge features a 5.5" (14 cm) LCD display that you can clearly view from over 5 m (16.4'). The large display, with its wide 150° viewing angle, provides one of the easiest to read LCDs in the industry.



### Zero footprint

Using the wall mount cradle (included), edge can be placed on a wall, leaving zero footprint on the benchtop space. The cradle has a built-in connector to power and charge the batteries.



## Hybrid meters that can be used in portable, wall-mount and benchtop configurations

The versatile design of edge® enables it to be used as a portable, wall-mount or benchtop meter. edge simplifies measurement, configuration, calibration, diagnostics, logging and transferring data directly to a computer or USB drive.



### Portable field unit

edge is ideal for field use due to its light weight, large screen, and thin design. It can easily be slipped into a backpack or messenger bag. The battery life lasts up to 8 hours when used as a portable device.



### Wall-mount cradle

The included wall-mount cradle makes it easy to conserve space on the benchtop while also charging edge with the AC adapter. The cradle is ideal for continuous monitoring applications.



### Electrode holder with built-in cradle

The electrode holder features a swivel, adjustable arm with a built-in cradle to hold edge securely in place at the optimum viewing angle.



## Digital electrodes

edge® measures pH, conductivity and dissolved oxygen through its unique digital electrodes. These digital electrodes are auto-recognized, providing sensor type, calibration data and a serial number when connected to edge by an easy to plug-in 3.5mm connector.

- Simply connect each probe via the 3.5 mm jack, Digital Smart Electrodes are automatically recognized

- Resolution selectable from 0.01 and 0.001 pH
- Range -2.000 to 16.000 pH
- Accuracy  $\pm 0.002$  pH for 0.001 pH resolution;  $\pm 0.01$  for 0.01 resolution
- Data logging
  - Manual log-on-demand
  - Manual log-on-stability
  - Interval logging
- Temperature readout ( $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ )
- Automatic Temperature Compensation (ATC)
- CAL Check™ Indicators:
  - Probe condition
  - Response time
  - Check buffer
  - Clean electrode
- Sensor Check™ Indicators:
  - Broken electrode
  - Clogged junction
- GLP data
  - Records date, time, offset, slope and buffers used during calibration
- Five-point calibration
  - A choice of seven pre-programmed buffers plus two selectable custom buffers
- Calibration tag on screen
  - Identifies buffers used for current calibration
- Calibration expiration warning

## Sleek design

Incredibly thin and lightweight, edge measures just 1/2" (12 mm) thick and weighs just 8.8 ounces (250 g).

All edge compatible pH, EC and dissolved oxygen digital probes are interchangeable with edge.

Specifications	HI2020	
pH	Range*	-2.00 to 16.00 pH; -2.000 to 16.000 pH <sup>†</sup>
	Resolution	0.01 pH; 0.001 pH <sup>†</sup>
	Accuracy (@25°C/77°F)	$\pm 0.01$ pH; $\pm 0.002$ pH <sup>†</sup>
	Calibration	automatic, up to three points (five points <sup>†</sup> ) calibration, 5 standard (7 standard <sup>†</sup> ) buffers available (1.68 <sup>†</sup> , 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45 <sup>†</sup> ) and two custom buffers <sup>†</sup>
	Temperature Compensation*	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using integral temperature sensor)
	Electrode Diagnostics	standard mode: probe condition, response time and out of calibration range
mV pH	Range	$\pm 1000$ mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	$\pm 0.2$ mV
Temperature	Range*	-20.0 to 120.0°C; -4.0 to 248.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	$\pm 0.5^{\circ}\text{C}$ ; $\pm 0.9^{\circ}\text{F}$
Additional Specifications	Probe (included in pH kit)	HI11310 digital glass body pH electrode with 3.5 mm (1/8") connector and 1 m (3.3') cable
	Logging	up to 1000 <sup>†</sup> (400 for basic mode) records organized in: manual log-on-demand (max. 200 logs), manual log-on-stability (max. 200 logs), interval logging <sup>†</sup> (max. 600 samples; 100 lots)
	Connectivity	1 USB port for storage; 1 micro USB port for charging and PC connectivity
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Power Supply	5 VDC adapter (included)
Dimensions / Weight	202 x 140 x 12 mm (7.9" x 5.5" x 0.5") / 250 g (8.82 oz.)	
Ordering Information	<b>HI2020-01</b> (115V) and <b>HI2020-02</b> (230V) pH kit includes: HI11310 glass body, refillable pH electrode, pH 4 buffer solution sachets (4), pH 7 buffer solution sachets (2), pH 10 buffer solution sachets (2), and electrode cleaning solution sachets (2), benchtop docking station with electrode holder, wall-mount cradle, USB cable, 5 VDC power adapter, quality certificates and instruction manual. All edge compatible pH, EC and DO digital probes are interchangeable with HI2020 and can be ordered separately.	

\* limits will be reduced to actual probe limits  
<sup>†</sup> standard mode only

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## edge<sup>®</sup>pH–Innovation dedicated to a single parameter

edge pH's groundbreaking design is the culmination of Hanna's vision, design capabilities, integrated production and world class R&D. edge pH is a single meter that can measure pH and ORP and is incredibly easy to use.

- Resolution selectable from 0.01 and 0.001 pH
- Range -2.000 to 16.000 pH
- Accuracy  $\pm 0.002$  pH for 0.001 pH resolution;  $\pm 0.01$  for 0.01 resolution
- Data logging
  - Manual log-on-demand
  - Manual log-on-stability
  - Interval logging
- Temperature readout ( $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ )
- Automatic Temperature Compensation (ATC)
- CAL Check<sup>™</sup> Indicators:
  - Probe condition
  - Response time
  - Check buffer
  - Clean electrode
- Sensor Check<sup>™</sup> Indicators:
  - Broken electrode
  - Clogged junction
- GLP data
  - Records date, time, offset, slope and buffers used during calibration
- Five-point calibration
  - A choice of seven pre-programmed buffers plus two selectable custom buffers
- Calibration tag on screen
  - Identifies buffers used for current calibration
- Calibration expiration warning

## edge®pH technical features

### Rechargeable Battery

edge pH has a built in rechargeable battery that is charged when the meter is in the plugged in benchtop or wall mount cradle. The battery can also be recharged through the micro USB port with either a USB port from a computer or directly to the power supply.



### Two USB ports

edge pH includes one standard USB for exporting data to a flash drive. edge blu also includes one micro USB port for exporting files to your computer as well as for charging when the cradle is not available.



### Clear, full text readout

edge pH features clear, full text guides displayed on the bottom of the screen. There is no need to decipher scrambled abbreviations or symbols; these helpful messages guide you through every process quickly and easily.



### Data logging

edge pH allows you to store up to 1000 log records of data. Data sets include readings, GLP data, date and time.

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### GLP

Data of the last calibration you perform is stored in the sensor including the date, time, and buffers used. When the sensor is connected to edge pH, GLP data is automatically transferred.

### Two Operating Modes

edge pH can be used in Extended or Basic Operating Modes. Extended Mode enables all edge features while Basic Mode reduces features—ideal for routine measurements by displaying a simplified screen and features.



### CAL Check

Hanna's exclusive CAL Check™ feature analyzes the pH electrode response in the pH buffers during the calibration process to alert the user of potential problems such as a contaminated buffer or dirty electrode. After calibration, indicators for probe condition are displayed on the measurement screen. The probe condition is based on offset and slope characteristics of the pH electrode.

### Sensor Check™

When used with Hanna's electrodes equipped with a matching pin, edge constantly checks the impedance of the pH measuring electrode to notify you in real time in the event of glass breakage. During calibration, Sensor Check checks the state of the junction. The reference junction is also evaluated and reported on the display.

### ORP Measurement

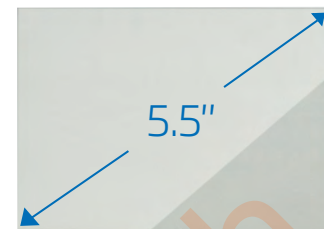
edge pH measures ORP with edge compatible ORP probes.

## edge pH design features



### Capacitive touch keypad

edge pH features sensitive capacitive touch buttons for accurate keystrokes when navigating edge's menus and screens. Since they are part of the screen, the buttons can never get clogged with sample residue.



### Easy to read LCD

edge pH features a 5.5" (14 cm) LCD display that you can clearly view from over 5 m (16.4'). The large display, with its wide 150° viewing angle, provides one of the easiest to read LCDs in the industry.



### Zero footprint

Using the wall mount cradle (included), edge pH can be placed on a wall, leaving zero footprint on the benchtop space. The cradle has a built-in connector to power and charge the batteries.



## A hybrid meter that can be used in portable, wall-mount and benchtop configurations

The versatile design of edge®pH enables it to be used as a portable, wall-mount or benchtop meter. edge pH simplifies measurement, configuration, calibration, diagnostics, logging and transferring data directly to a computer or USB drive.



### Portable field unit

edge pH is ideal for field use due to its light weight, large screen, and thin design. It can easily be slipped into a backpack or messenger bag. The battery life lasts up to 8 hours when used as a portable device.



### Wall-mount cradle

The included wall-mount cradle makes it easy to conserve space on the benchtop while also charging edge pH with the AC adapter. The cradle is ideal for continuous monitoring applications.



### Electrode holder with built-in cradle

The electrode holder features a swivel, adjustable arm with a built-in cradle to hold edge pH securely in place at the optimum viewing angle.



### 3.5 mm probe input

Plugging an electrode in has never been simpler; no alignments or broken pins, simply connect the 3.5 mm plug and begin. Digital electrodes are automatically recognized.

### Sleek design

Incredibly thin and lightweight, edge®pH measures just 1/2" (12 mm) thick and weighs just 8.8 ounces (250 g).



### Specifications

#### edge pH

pH	Range*	-2.00 to 16.00 pH; -2.000 to 16.000 pH <sup>†</sup>
	Resolution	0.01 pH; 0.001 pH <sup>†</sup>
	Accuracy (@25°C/77°F)	±0.01 pH; ±0.002 pH <sup>†</sup>
	Calibration	automatic, up to three points (five points <sup>†</sup> ) calibration, 5 standard (7 standard <sup>†</sup> ) buffers available (1.68 <sup>†</sup> , 4.01 or 3.00, 6.86, 7.01, 9.18, 10.01, 12.45 <sup>†</sup> ) and two custom buffers <sup>†</sup>
	Temperature Compensation*	automatic, -5.0 to 100.0°C (23.0 to 212.0°F) (using integral temperature sensor)
	Electrode Diagnostics	standard mode: probe condition, response time and out of calibration range
mV pH	Range	±1000 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±0.2 mV
ORP	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy (@25°C/77°F)	±0.2 mV (±999.9 mV); ±1 mV (±2000 mV)
	Calibration	one-point calibration
Temperature	Range*	-20.0 to 120.0°C; -4.0 to 248.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C; ±0.9°F
Additional Specifications	Probe	HI11310 digital glass body pH electrode with 3.5 mm (1/8") connector and 1 m (3.3") cable
	Logging	up to 1000 <sup>†</sup> (400 for basic mode) records organized in: manual log-on-demand (max. 200 logs), manual log-on-stability (max. 200 logs), interval logging <sup>†</sup> (max. 600 samples; 100 lots)
	Connectivity	1 USB port for storage; 1 micro USB port for charging and PC connectivity
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Power Supply	5 VDC adapter (included)
	Dimensions	202 x 140 x 12 mm (7.9" x 5.5" x 0.5")
Weight	250 g (8.82 oz.)	
Ordering Information	<b>HI2002-01</b> (115V) and <b>HI2002-02</b> (230V) edge pH includes: HI11310 glass body, refillable pH electrode, pH 4 buffer solution sachets (4), pH 7 buffer solution sachets (2), pH 10 buffer solution sachets (2), electrode cleaning solution sachets (2), benchtop docking station with electrode holder, wall-mount cradle, USB cable, 5 VDC power adapter, quality certificates and instruction manual.	

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\* limits will be reduced to actual probe limits  
† standard mode only

## Research Grade Meter

pH/ORP/ISE and Temperature

pH

benchtop



The HI5222 is an advanced research grade benchtop pH/mV/ISE dual channel meter that is completely customizable with a large color LCD, capacitive touch keys, and USB port for computer connectivity.

The HI5222 features two galvanically isolated BNC connections for use with the expansive line of pH, ISE and ORP electrodes that Hanna Instruments offers. The meter is supplied with the HI1131B glass body, double junction, combination pH electrode that operates over a wide range of temperature from 0 to 100°C. All readings are automatically compensated for temperature variations with the separate HI7662-T temperature probe that is included.

As a pH meter the HI5222 can be calibrated up to five points with eight pre-programmed buffers or five custom buffers. The HI5222 features Hanna's exclusive CAL Check™ to alert the user of potential problems during the pH calibration process. Indicators displayed during calibration include "Electrode Dirty/Broken" and "Buffer Contaminated." The overall probe condition based on the offset and slope characteristic of the electrode is displayed as a percentage after calibration is complete.

As an ISE meter the HI5222 can be calibrated up to five points with a choice of five fixed standards or five user defined in any

concentration unit. The calibration data including date, time, standards used and slope can be viewed at any time along with the current measurement by selecting the Good Laboratory Practice (GLP) display option.

Three selectable logging modes are available: automatic, manual and AutoHold logging. Up to 100,000 data points per channel can be recorded in 100 lots, 50,000 records max/lot and exported to a computer for data review and storage.



## Customizable User Interface

The user interface of the HI5222 allows the user to show measurements in various modes: basic measurement with or without GLP information, real-time graphing, and logging data. Calibration stability criteria can be adjusted from fast, moderate, and accurate. Programmable alarm limits can be set to inside or outside allowable limits.

## Color Graphic LCD

The HI5222 features a color graphic LCD with on-screen help, graphic, and custom color configurations. The display allows for real-time graphing and the use of virtual keys provide for an intuitive user interface.

## Capacitive Touch

The HI5222 features sensitive capacitive touch buttons for accurate keystrokes when navigating menus and screens. There are four dedicated keys that are used for routine operations including calibration and switching measurement modes and four virtual keys that change based upon use. The capacitive touch technology ensures the buttons never get clogged with sample residue.

## Two Galvanically Isolated pH/ORP/ISE Channels

The HI5222 has two input channels that can be used for pH, ORP and ISE electrodes. Each input channel has connectors for BNC probes, reference probes and a temperature sensor. Each channel is galvanically isolated which means that two measurement probes can be in the same solution at the same time and the voltages produced will not interfere with each other.

## Choice of Calibration

Automatic buffer recognition, semi-automatic, and direct manual entry pH calibration options are available for calibrating up to five points, from a selection of eight standard buffers and up to five custom buffers.

## GLP Data

HI5222 includes a GLP Feature that allows users to view calibration data and calibration expiration information at the touch of a key. Calibration data include date, time, buffers used for calibration, and electrode offset and slope characteristics.

## CAL Check™

CAL Check alerts users to potential problems during the calibration of the pH electrode. Indicators include "Electrode Dirty/Broken," "Buffer Contaminated," electrode response time and the overall probe condition as a percentage that is based on the offset and slope characteristics.

## ISE Measurement with Choice of Concentration Units

The HI5222 allows for calibration and readings in choice of concentration units. The choices of concentration units include ppt, g/L, mg/mL, ppm, mg/L, µg/mL, ppb, µg/L, mg/mL, M, mol/L, mmol/L, %w/v and a user-defined unit.

## ISE Measurement with Incremental Methods

The known addition, known subtraction, analyte addition, and analyte subtraction

incremental methods are pre-programmed into the HI5222. Simply follow the on screen guided procedure and the meter will perform the calculation automatically allowing for a higher level of accuracy to be obtained as compared to a direct ISE measurement.

## Data Logging

Three selectable logging modes are available on the HI5222: automatic, manual, and AutoHold logging. Automatic and manual logs up to 100 lots with 50,000 records max/lot with up to 100,000 total data points per channel. Automatic logging features the option to save data according to sampling period and interval.

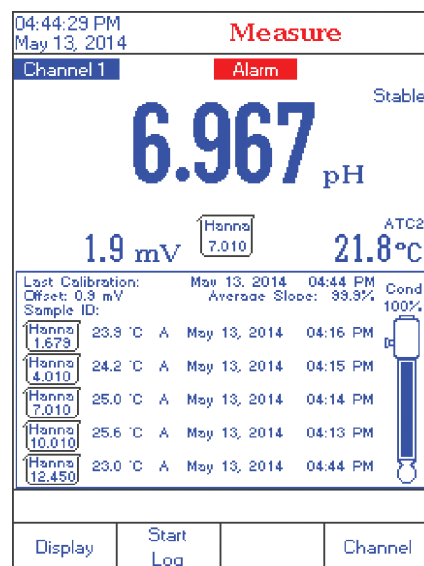
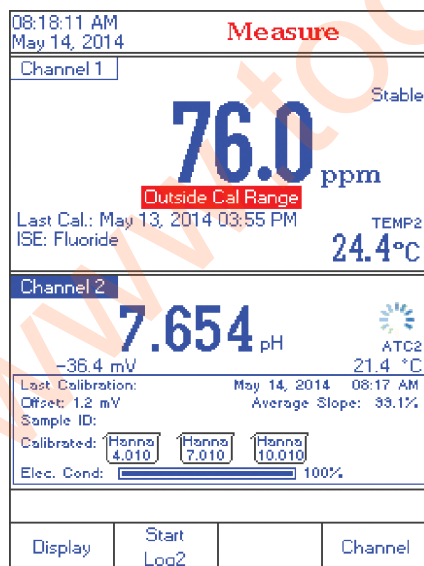
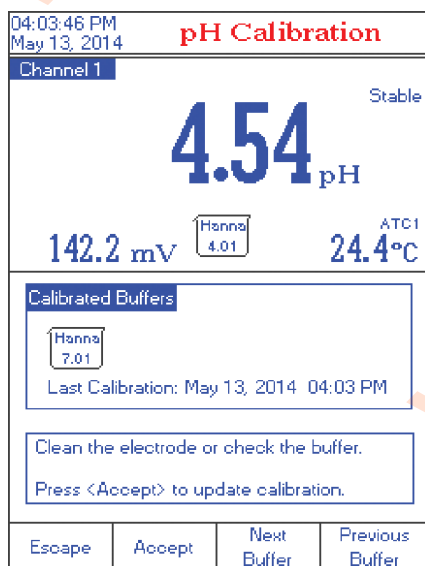
## Data Transfer

Data can be transferred to a PC with USB cable and HI92000 software (both sold separately).

## Contextual Help

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.

## CAL Check™ Screens



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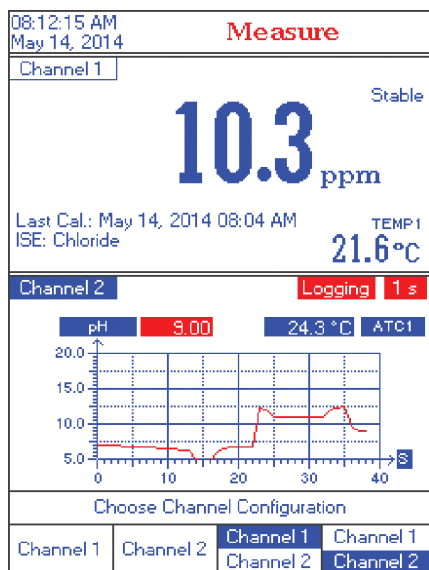
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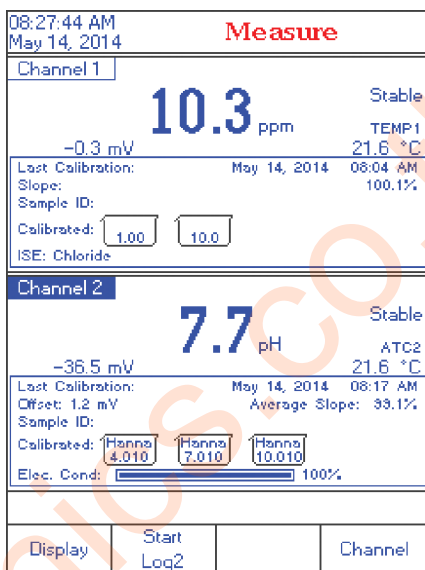
## Additional Features by Screen

pH

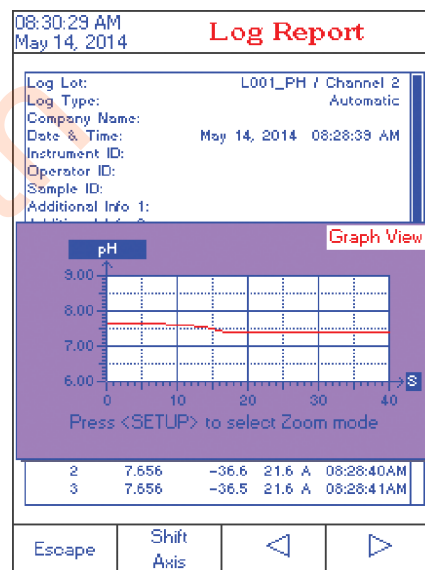
benchtop



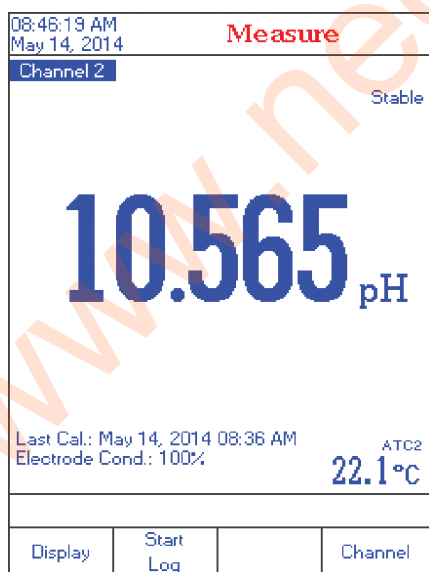
Channel Configuration



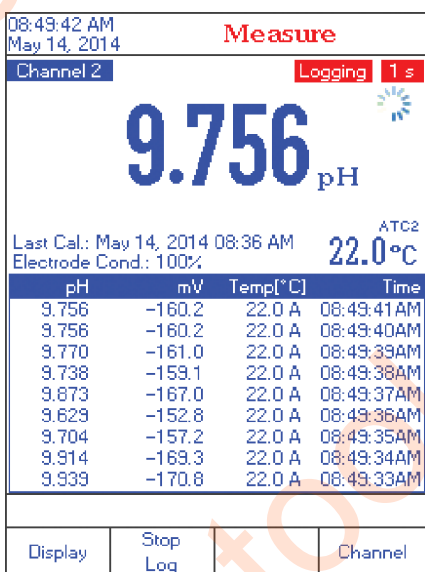
Good Laboratory Practices



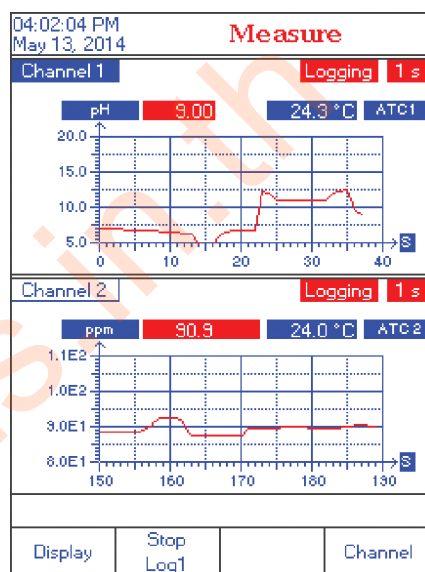
Log Recall



Basic Display



Real-Time Logging



Simultaneous Dual Channel Graphing



## Dual Channels

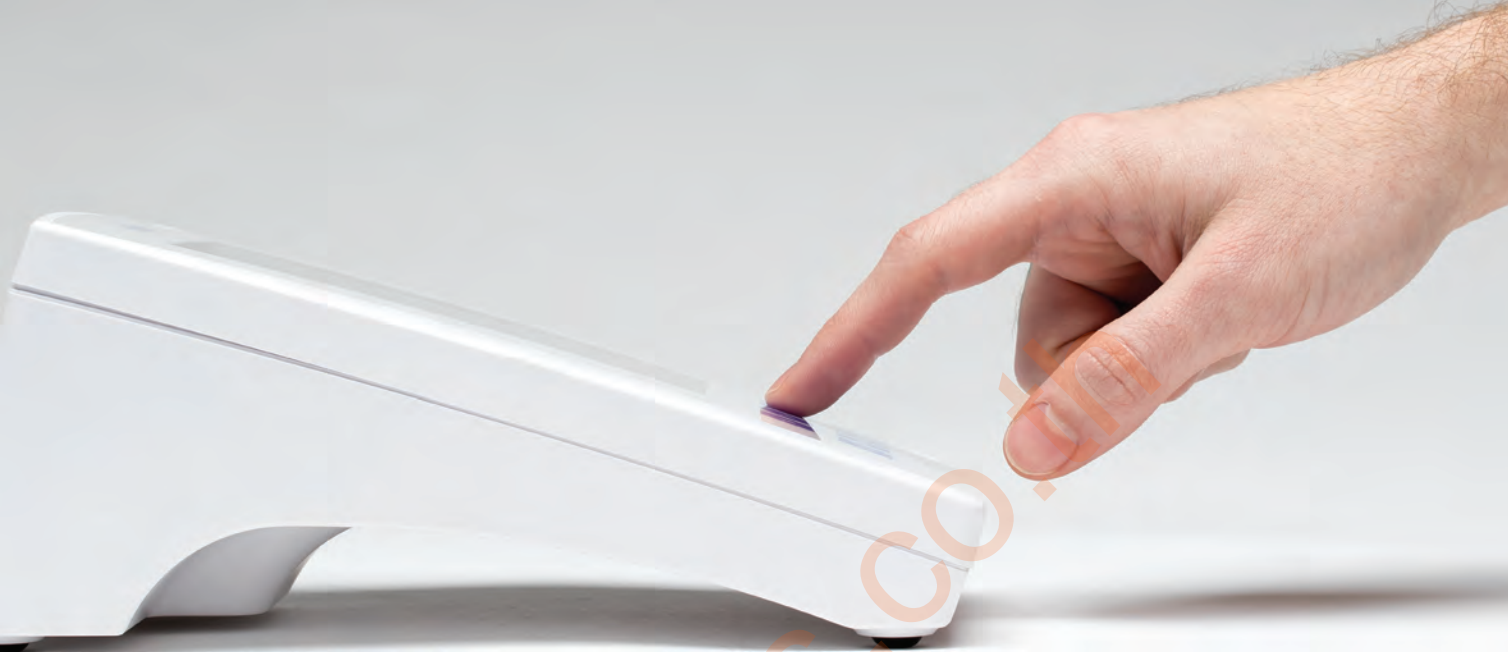
The two measurement channels of the HI5222 are galvanically isolated to eliminate noise and instability.

In ISE mode, this instrument provides a choice of several incremental methods. Communication is via opto-isolated USB.

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## Specifications

## HI5222

pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD
	Calibration	automatic, up to five point calibration, eight standard buffers available (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45), and five custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C/-4.0 to 248.0°/253.15 to 393.15K
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV ±1 LSD
	Relative mV Offset Range	±2000 mV
ISE	Range	1 x 10 <sup>-6</sup> to 9.99 x 10 <sup>10</sup> concentration
	Resolution	1; 0.1; 0.01; 0.001 concentration
	Accuracy	±0.5% (monovalent ions); ±1% (divalent ions)
	Calibration	automatic, up to five-point calibration, seven fixed standard solutions available for each measurement unit, and five user defined standards
Temperature*	Range	-20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K
	Resolution	0.1°C; 0.1°F; 0.1K
	Accuracy	±0.2°C; ±0.4°F; ±0.2K
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)
	Input Channel(s)	2 pH/ORP/ISE
	GLP	calibration points, calibration time stamp, probe offset, slope, date, time and buffers/standards used
	Logging	<b>record</b> : 100,000 data point storage/channel, 100 lots with 50,000 records/lot; <b>interval</b> : fourteen presets selectable between 1 second and max log time of 180 minutes; <b>type</b> : automatic, manual, AutoHold
	Display	color graphic LCD 240x340 pixels
	PC Connection	USB
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing
	Dimensions	160 x 231 x 94 mm (6.3 x 9.1 x 3.7")
	Weight	1.2 kg (2.64 lbs.)
Ordering Information	<b>HI5222-01</b> (115V) and <b>HI5222-02</b> (230V) are supplied with HI1131B pH electrode, HI7662-T temperature probe, pH 4.01 buffer solution sachet (2), pH 7.01 buffer solution sachet (2), HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404W electrode holder, 12 VDC adapter, capillary dropper pipette, quality certificate, quick start guide and instruction manual.	

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## Research Grade Meter

pH/ORP and Temperature

pH

benchtop



The HI5221 is an advanced research grade benchtop pH/mV meter that is completely customizable with a large color LCD, capacitive touch keys, and USB port for computer connectivity.

The HI5221 features a universal BNC connection for use with the expansive line of pH and ORP electrodes that Hanna Instruments offers. The meter is supplied with the HI1131B glass body, double junction, combination pH electrode that operates over a wide temperature range from 0 to 100°C. All readings are automatically compensated

for temperature variations with the separate HI7662-T temperature probe that is included.

The HI5221 can be calibrated up to five points with a choice of eight pre-programmed buffers or five custom buffers. The HI5221 features Hanna's exclusive CAL Check™ to alert the user of potential problems during the pH calibration process. Indicators displayed during calibration include "Electrode Dirty/Broken" and "Buffer Contaminated." The overall probe condition based on the offset and slope characteristic of the electrode is displayed as a percentage after calibration

is complete. The calibration data including date, time, buffers used, offset and slope can be accessed at any time along with the current measurement by selecting the Good Laboratory Practice (GLP) display option.

Three selectable logging modes are available: automatic, manual and AutoHold logging. Up to 100,000 data points can be recorded in 100 lots with 50,000 records max/lot and exported to a computer for data review and storage.

## Customizable User Interface

The user interface of the HI5221 allows the user to show measurements in various modes: basic measurement with or without GLP information, real-time graphing, and logging data. Calibration stability criteria can be adjusted from fast, moderate, and accurate. Programmable alarm limits can be set to inside or outside allowable limits.

## Color Graphic LCD

The HI5221 features a color graphic LCD with on-screen help, graphic, and custom color configurations. The display allows for real-time graphing and the use of virtual keys provide for an intuitive user interface.

## Capacitive Touch

The HI5221 features sensitive capacitive touch buttons for accurate keystrokes when navigating menus and screens. There are four dedicated keys that are used for routine operations including calibration and switching measurement modes and four virtual keys that change based upon use. The capacitive touch technology ensures the buttons never get clogged with sample residue.

## Choice of Calibration

Automatic buffer recognition, semiautomatic, and direct manual entry pH calibration options are available for calibrating up to five points, from a selection of eight standard buffers and up to five custom buffers.

## GLP Data

HI5221 includes a GLP feature that allows users to view calibration data and calibration expiration information at the touch of a key. Calibration data include date, time, buffers /standards used for calibration and slope characteristics. The offset is also displayed for pH electrodes.

## CAL Check™

CALCheck™ alerts users to potential problems during the calibration of the pH electrode. Indicators include "Electrode Dirty/Broken," "Buffer Contaminated," electrode response time and the overall probe condition as a percentage that is based on the offset and slope characteristics.

## Data Logging

Three selectable logging modes are available on the HI5221: automatic, manual, and AutoHold logging. Automatic and manual logs up to 100 lots with 50,000 records max/lot, with up to 100,000 total data points. Automatic logging features the option to save data according to sampling period and interval.

## Data Transfer

Data can be transferred to a PC with USB cable and HI92000 software (both sold separately).

## Contextual Help

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.

## Specifications

### HI5221

pH	Range	-2.0 to 20.0 pH; -2.00 to 20.00; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH ±1 LSD
	Calibration	automatic, up to five point calibration, eight standard buffers available (1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45), and five custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C/-4.0 to 248.0°F/253.15 to 393.15K
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV ±1 LSD
	Relative mV Offset Range	±2000 mV
Temperature*	Range	-20.0 to 120°C; -4.0 to 248.0°F; 253.15 to 393.15K
	Resolution	0.1°C; 0.1°F; 0.1K
	Accuracy	±0.2°C; ±0.4°F; ±0.2K
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature Probe	HI7662-T stainless steel temperature probe with 1 m (3.3') cable (included)
	Input Channel(s)	1 pH/ORP
	GLP	calibration points, calibration time stamp, probe offset, slope, date, time and buffers/standards used
	Logging	<b>record</b> : 100,000 data point storage/channel, 100 lots with 50,000 records/lot; <b>interval</b> : fourteen presets selectable between 1 second and max log time of 180 minutes; <b>type</b> : automatic, manual, AutoHold
	Display	color graphic LCD 240x340 pixels
	PC Connection	USB
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F; 273 to 323K) RH max 95% non-condensing
	Dimensions	160 x 231 x 94 mm (6.3 x 9.1 x 3.7")
Weight	1.2 kg (2.64 lbs.)	
Ordering Information	<b>HI5221-01</b> (115V) and <b>HI5221-02</b> (230V) are supplied with HI1131B pH electrode, HI7662-T temperature probe, pH 4.01 buffer solution sachet (2), pH 7.01 buffer solution sachet (2), HI700601 electrode cleaning solution sachet (2), HI7082 3.5M KCl electrolyte solution (30 mL), HI76404W electrode holder, 12 VDC adapter, capillary dropper pipette, quality certificate, quick start guide and instruction manual.	

(\*) Reduced to actual probe limits

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## pH Benchtop Meter

with Built-in Printer

The HI122 is a professional pH/mV and temperature benchtop meter with a built-in printer. The built-in impact printer incorporated into the HI122 allows measurement information to be printed while in various modes. The meter comes with Hanna's HI1131P glass pH electrode and the temperature probe HI7662-T to allow for automatic temperature compensation. The HI122 also allows for ORP measurements when used with the HI3131B ORP electrode (supplied separately).



### CAL Check™

Hanna's exclusive CAL Check™ diagnostics system ensures accurate pH readings every time by alerting users of potential problems during the calibration process. The CAL Check™ system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions during calibration. After the guided calibration process, the probe condition is evaluated and an indicator is displayed informing the user of the overall pH electrode status.

### Automatic Calibration

pH calibration can be performed up to five points with seven standard buffers and two custom buffers.

### HI1131P pH Electrode

The HI122 is supplied with the HI1131P glass body, double junction, refillable pH electrode with an indicating sensor made of High Temperature (HT) glass. The double junction and HT glass design allows the HI1131P to be used in a wide variety of applications ranging from samples with metals and Tris buffer to samples at elevated temperatures.

### Temperature Compensation

Temperature for pH measurements can be compensated for automatically (ATC) or manually (MTC) from -20.0 to 120.0°C with the use of the supplied HI7662-T temperature probe.

### GLP Data

The calibration data for each channel including date, time, standards used, offset, and slope can be accessed at any time through the HI122 menu.

### Data Logging

The log-on-demand feature accepts the recording of 50 samples. Interval logging allows up to 1000 data points to be recorded and allows the user to specify time intervals from 5 seconds to 180 minutes.

### Data Transfer

With a built-in logging function, measurements are stored in non-volatile memory, and can be transferred to a PC through the RS232 port.



### Built-in Impact Printer

The built-in impact printer incorporated into the HI122 uses regular paper that does not fade with time. The information related to measurements being taken can be printed while in measurement mode, GLP or Setup mode. This meter also allows users to print detailed information in four languages for specific help screens and instrument set-up.

### Secondary keypad

### Built-in impact printer

Specifications	HI122	
pH	Range	-2.00 to 16.00 pH; -2.000 to 16.000 pH
	Resolution	0.01 pH; 0.001 pH
	Accuracy @25°C	±0.01 pH; ±0.002 pH
	Calibration	automatic, up to five point calibration standard with seven buffers (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and two custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120°C (-4.0 to 248.0°F)
mV	Range	±999.9; ±2000 mV
	Resolution	0.1 mV; 1 mV
	Accuracy @25°C	±0.2 mV (±699.9 mV); ±0.5 mV (±999.9 mV); ±1 mV (±2000 mV)
	Relative mV Offset Range	±2000 mV
Temperature	Range	-20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy @25°C	±0.4°C (±0.7°F)
Additional Specifications	pH Electrode	HI1131P glass body pH electrode with BNC + pin connectors and 1 m (3.3') cable (included)
	Temperature Probe	HI7662-T temperature probe with 1 m (3.3') cable (included)
	Log-on-demand	50 samples (25 per channel)
	Interval Logging	5 second to 180 minutes, 1000 samples (500 per channel)
	Input Impedance	10 <sup>12</sup> Ohm
	PC Connection	RS232 serial port, opto-isolated
	Printer	built-in dot matrix printer, with 44 mm plain paper
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions	280 x 203 x 84 mm (11.0 x 8.0 x 3.3")
Weight	1.9 kg (4.2 lbs.)	
Ordering Information	<b>HI122-01</b> (115V) and <b>HI122-02</b> (230V) are supplied with HI1131P pH electrode, HI7662-T temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI7082 3.5M KCL electrolyte solution (30 mL), (5) paper rolls, 12 VDC adapter and instructions.	

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# Benchtop pH/mV Meter

with CAL Check

The HI2221 pH/mV benchtop meter features CAL Check™, data logging capability, and USB port for computer connectivity. Readings for pH can be manually or automatically compensated for temperature variations with the separate HI7662 temperature probe from -20.0 to 120.0°C.

## CAL Check™

Hanna's exclusive CAL Check™ diagnostics system ensures accurate pH readings every time by alerting users of potential problems during the calibration process. The CAL Check™ system eliminates erroneous readings due to dirty or faulty pH electrodes or contaminated pH buffer solutions during calibration. After the guided calibration process, the probe condition is evaluated and an indicator is displayed informing the user of the overall pH electrode status.

## Automatic Calibration

Automatic pH calibration can be performed at up to 5 points using 7 standard buffers (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, and 12.45).

## GLP Data

The calibration data for each channel including date, time, standards used, offset, and slope can be accessed when the instrument is in pH measuring mode.

## HI1131P pH Electrode

The HI2221 is supplied with the HI1131P glass body, double junction, refillable pH electrode with a BNC and pin connector. This design consideration is ideal for laboratory samples, liquid samples, and high temperature samples, as well as general purpose use.

## mV mode

HI2221 has a mV mode that can be used with ORP electrodes and for relative mV readings.

## Data Logging

The log-on-demand feature allows up to 100 data points to be recorded.

## Data Transfer

Data can be transferred to a PC with a USB cable and HI92000 software (both sold separately).



### Specifications

	HI2221	
pH	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.01 pH
	pH Calibration	automatic, up to five point calibration with seven standard buffer available (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45)
	Temperature Compensation	Manual or Automatic from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±699.9 mV; ±2000 mV
	Resolution	0.1 mV (±699.9 mV); 1 mV (±2000 mV)
	Accuracy	±0.2 mV (±699.9 mV); ±1 mV (±2000 mV)
Temperature	Range	-20.0 to 120.0°C (-4.0 to 248.0°F)
	Resolution	0.1°C
	Accuracy	±0.2 °C (Excluding probe error)
Additional Specifications	pH Electrode	HI1131P glass body pH electrode with BNC + Pin connector and 1 m (3.3') cable (included)
	Logging Memory	log-on-demand up to 100 records
	Input Impedance	10 <sup>12</sup> Ohm
	Connectivity	opto-isolated USB
	Power Supply	12 VDC adapter (included)
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing
	Dimensions / Weight	235 x 222 x 109 mm (9.2 x 8.7 x 4.3") / 1.3 Kg (2.9 lb)
	Ordering Information	HI2221-01 (115V) and HI2221-02 (230V) are supplied with HI1131P pH electrode, HI7662 temperature probe, HI76404N electrode holder, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI7071S electrolyte solution, HI700661 cleaning solution sachet, 12 VDC adapter, and instructions.

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## pH Benchtop Meters

- Automatic temperature compensation (ATC)
- Two-point calibration
- Simple to operate
- Reading stability indicator
- Measurement recall

The HI2211 and HI2210 are accurate and affordable benchtop pH and °C meters. The HI2211 can also be used to measure Oxidation Reduction Potential (ORP) in the mV range.

The calibration process is guided step-by-step through graphics shown on the LCD.

Designed to be easy to use, these instruments also feature a reading stability indicator used during calibration and a measurement recall function.

pH measurements for both instruments are compensated for the temperature effect manually or automatically with the HI7662 temperature probe. These instruments are also equipped with an easy-to-read LCD which shows both the primary reading and °C.



Specifications	HI2210	HI2211	
pH	Range	-2.00 to 16.00 pH	-2.00 to 16.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy	±0.01 pH	±0.01 pH
	pH Calibration	automatic, one or two-point with five memorized buffer values (pH 4.01, 6.86, 7.01, 9.18, 10.01)	
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C	
mV	Range	-	±399.9 mV; ±2000 mV
	Resolution	-	0.1 mV; 1 mV
	Accuracy	-	±0.2 mV (±399.9 mV); ±1 mV (±2000 mV)
Temperature	Range	-9.9 to 120.0°C (14.2 to 248.0°F)	
	Resolution	0.1°C	0.1°C
	Accuracy	±0.5°C	±0.5°C
Additional Specifications	pH Electrode	HI1131B glass body pH electrode with BNC connector and 1 m (3.3') cable (included)	
	Temperature Probe	HI7662 stainless steel temperature probe with 1 m (3.3') cable (included)	
	Input Impedance	10 <sup>12</sup> Ohm	
	Power Supply	12 VDC adapter (included)	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions / Weight	240x182x74 mm (9.4x7.1x2.9"); 1.1 Kg (2.5 lb)	
Ordering Information	<b>HI2210-01</b> (115V), <b>HI2210-02</b> (230V), <b>HI2211-01</b> (115V) and <b>HI2211-02</b> (230V) are supplied with HI1131B pH electrode, HI7662 temperature probe, HI76404N electrode holder, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI7082 3.5M KCl electrolyte solution (30 mL), HI700601 cleaning solution sachet, 12 VDC adapter and instructions.		

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# pH Benchtop Meters

with Manual Temperature Compensation and Analog Output

- **Manual pH calibration**
  - This simple to use feature provides the ability to demonstrate the concept of offset and slope. It can be calibrated to any value within the measurement ranges and is less expensive than models with automatic calibration
- **Manual temperature compensation (MTC)**
  - MTC provides the ability to demonstrate the effect of temperature on pH measurement. It is simple to use and allows for different temperature corrections based on the sample being tested.
- **Analog output (HI22091 only)**
  - Allows a recording device to be connected to the meter.
- **mV range**
  - These pH/mV meters can also measure ORP (oxidation reduction potential) or ion concentration (ISE) in the extended mV range with optional electrodes.
- **Large LCD**
  - The new, larger LCD is bright and easy to read.
- **Built-in solution holders**
  - These meters have solution holders built into the casing. This convenient feature saves space and prevents solutions from tipping over



The HI22091 pH/mV Meter with manual temperature compensation (MTC) and analog output provides a simple to use, cost effective method of measuring pH. The HI22091 features a large, easy to read LCD and built-in solution holders. HI2209 has all the features of the HI22091 with the exception of analog output.

In order to achieve maximum accuracy, the HI22091 and HI2209 feature manual pH calibration at one or two points. Manual calibration enables the user to select the instrument's calibration points closer to the desired range of measurement, making them ideal for applications that require custom calibration points. (In some applications, a standard calibration curve such as pH 7 or pH 4 is too far from the value of the sample to achieve the highest accuracy.

Specifications		HI2209	HI22091
pH	Range	0.00 to 14.00 pH	0.00 to 14.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy	±0.01 pH	±0.01 pH
	Calibration	manual, one or two-point	manual, one or two-point
	Temperature Compensation	manual from 0 to 100°C (32 to 212°F)	
mV	Range	±1999 mV	±1999 mV
	Resolution	1 mV	1 mV
	Accuracy	±1 mV	±1 mV
Additional Specifications	pH Electrode	HI1332B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included)	
	Input Impedance	10 <sup>12</sup> Ohm	10 <sup>12</sup> Ohm
	Analog Output	–	0 to 5 V according with: 0 to 14 pH or -1999 to +1999 mV, temp.: always 0
	Power Supply	12 VDC adapter (included)	
	Environment	0 to 50°C (32 to 122°F); RH max 95% non-condensing	
	Dimensions / Weight	235 x 222 x 109 mm (9.2 x 8.7 x 4.3") / 1.3 kg (2.9 lbs.)	
<b>Ordering Information</b>	<b>HI2209-01</b> (115V), <b>HI2209-02</b> (230V), <b>HI22091-01</b> (115V) and <b>HI22091-02</b> (230V) are supplied with HI1332B pH electrode, 12 VDC adapter and instruction manual.		

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HI9126

## Portable pH/mV Meter



- **CAL Check™**
  - Alerts users of calibration status
- **Backlight**
  - Backlit, multi-level LCD display
- **Battery Error Prevention System (BEPS)**
  - Automatically shuts off meter when battery is too low to take accurate readings
- **Battery indicator**
  - Battery percentage displayed on startup
- **Help feature**
  - Tutorial messages displayed on LCD

The HI9126 includes Hanna's exclusive CAL Check™ technology. CAL Check™ monitors the pH bulb every time the instrument is calibrated. In the event of a dirty pH electrode, CAL Check™ warns users that maintenance may be needed.

Calibrated buffers are continuously displayed in measurement mode to remind users of the instrument's calibration point. Users can easily determine if readings are taken too far outside the calibration range.

The HI9126 can store and recall a reading at the touch of a button and features a real-time clock.

HI9126 utilizes the HI1230B double junction pH electrode. The double junction design helps to minimize junction contamination for consistently accurate results. The HI9126 can also measure ORP in the mV range using an optional ORP probe.

### Specifications

### HI9126

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.01 pH
	Calibration	automatic, one or two-point with seven standard buffers available (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and two custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±699.9 mV; ±1999 mV
	Resolution	0.1 mV; 1 mV
	Accuracy	±0.2 mV; ±1 mV
Temperature*	Range	-20.0 to 120.0°C; -4.0°F to 248.0°F
	Resolution	0.1°C; 0.1 °F
	Accuracy	±0.4°C; ±0.8°F
Additional Specifications	pH Electrode	HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature Probe	HI7662 stainless steel temperature probe with 1 m (3.3') cable (included)
	Slope / Offset Calibration	from 80 to 108% / ±1 pH
	Input Impedance	10 <sup>12</sup> Ohm
	Battery Type / Life	1.5V (3) AAA / approximately 200 hours of continuous use without backlight (50 hours with backlight)
	Auto-off	after 20 minutes of non-use (can be disabled)
	Environment	0 to 50°C (32 to 122°F); RH max 100%
	Dimensions / Weight	185 x 72 x 36 mm (7.3 x 2.8 x 1.4") / 300 g (10.6 oz.)
Ordering Information	HI9126 is supplied with HI1230B pH electrode, HI7662 temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer sachet, HI700601 electrode cleaning solution sachet, 100 mL plastic beaker, 1.5V AAA batteries (3), instructions and hard carrying case.	

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\* Limits will be reduced to actual sensor limits

HI98190

## Professional Waterproof Meter

pH/ORP

- **Waterproof**
  - IP67 rated waterproof, rugged enclosure
- **CAL Check™**
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer and overall probe condition
- **Automatic or manual temperature compensation**
  - pH sensors incorporate a built-in temperature sensor
- **Calibration**
  - Up to a five-point calibration with seven standard buffers and five custom buffers available
- **Approximately 200 hour battery life**
  - Powered by (4) 1.5V AA batteries
- **Clear display**
  - Dot matrix display with multifunction virtual keys
- **AutoHold**
  - Automatically holds the first stable reading on the display
- **Calibration timeout**
  - Alerts when calibration is due at a specified interval
- **Connectivity**
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- **GLP**
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- **Intuitive keypad**
  - Most of the available options such as GLP information, help, range, calibration and backlight have a dedicated button
- **Supplied complete**
  - Each meter is supplied complete with sensor, calibration solution, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case.



### Designed for professionals

The HI98190 is a rugged, portable pH meter with the performance and features of a benchtop meter. Exchange out the pH probe for an ORP probe to obtain mV readings in the  $\pm 2000$  mV range. This professional, waterproof meter can easily be operated with one hand and complies with IP67 standards. The HI98190 is supplied with all necessary accessories to perform a pH/temperature measurement packaged into a durable carrying case.

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### Backlit Graphic LCD Display

The HI98190 features a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

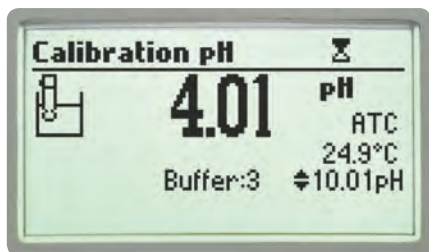
### Waterproof Protection

The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes. The probe features an IP68 rating for continuous immersion in water.



### Quick Connect Probe

The HI98190 features the HI12963 titanium bodied pH/temperature electrode with a quick connect DIN connector to make attaching and removing the probe simple and easy.



### pH Calibration

Choose from seven standard pH buffers and five custom pH buffers to obtain up to five point calibration and achieve high precision readings with a pH accuracy of  $\pm 0.002$  and up to  $\pm 0.001$  pH resolution.

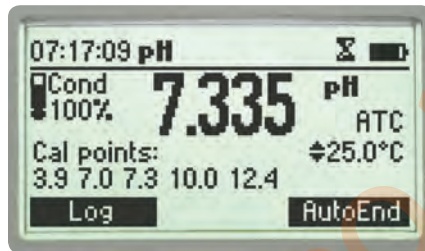
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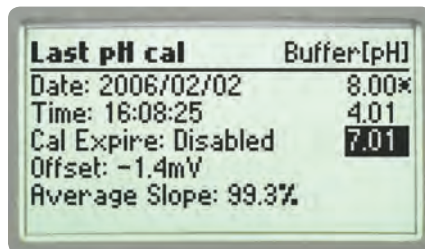
### Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of range.



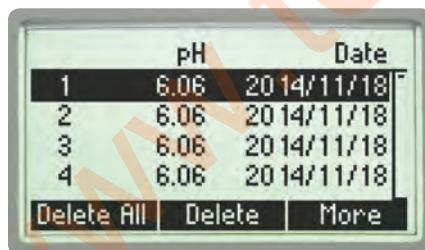
### CAL Check™

Hanna's CAL Check maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.



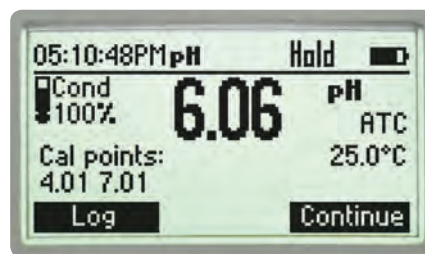
### GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time and calibration values are stored for retrieval at a later time.



### Data Logging

The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.



### AutoHold

Pressing AutoHold during measurement will automatically hold the first stable reading on the display.

### Intuitive Keypad

The fitted rubber keypad has dedicated keys for power, backlight, up/down arrows, help and alphanumeric characters. The meter also features two virtual soft keys that navigate the user through the configuration of each parameter, meter setup, and logging of data. The interface is intuitive for any user's level of experience.



### Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.

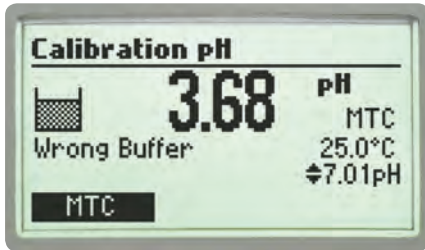


### Setup Screen

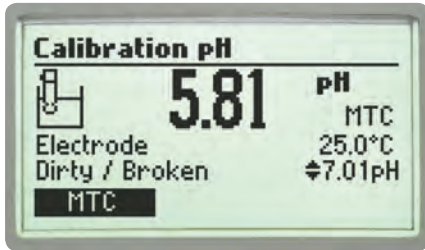
Our extensive setup screen features a host of configurable options such as time, date, temperature units and language for help screens and guides.

## Calibration Error Messages

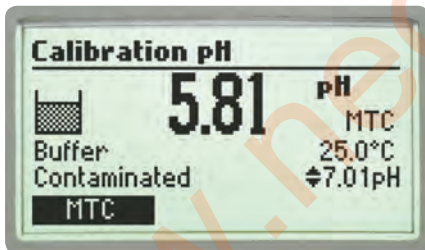
Calibration is successfully performed if the reading is within certain limits.



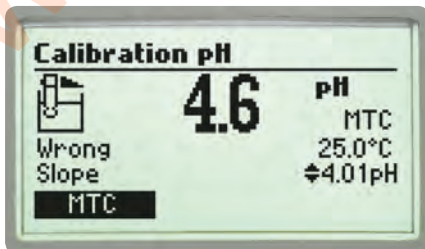
Wrong Buffer – The pH reading is not within range of the selected buffer.



Electrode Dirty/Broken alternatively with



Buffer Contaminated – The offset of the electrode is not in the accepted range. Check if the electrode is broken or clean it following the Cleaning Procedure at the end of this section. Check the quality of the buffer. If necessary, change the buffer.



Wrong or Wrong Old Slope – An inconsistency between new and previous (old) calibration is detected.



## PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.



## Long Battery Life

The display of the meter has a battery icon to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.



## Supplied Complete in a Rugged Custom Carrying Case

The HI98190 meter, probe, and all accessories are supplied in the HI720190 rugged carrying case designed to provide years of use. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.



## HI12963 pH Electrode

- **Titanium body**
  - Titanium construction provides an unbreakable structure and allows the transfer of heat to the internal temperature sensor for rapid temperature compensation.
- **Maintenance free, gel-filled electrode**
  - No fill solution required.

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## Calibrate right in the case with custom beaker holders

Our custom carrying case features beaker holders for calibration out in the field.



pH

portable

Specifications	HI98190	
pH*	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH
	Calibration	up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV*	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
	Relative mV Offset Range	±2000 mV
Temperature*	Range	-20.0 to 120.0 °C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.4°C (±0.8°F) (excluding probe error)
Additional Specifications	pH Probe	HI12963 titanium body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable)
	Slope Calibration	from 80 to 110%
	Log-on-demand	200 samples (100 each pH/mV range)
	PC Connection	opto-isolated USB with HI92000 software and micro USB cable
	Input Impedance	10 <sup>12</sup> Ω
	Battery Type / Life	1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight)
	Auto-off	user selectable: 5, 10, 30, 60 min, disabled
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
Ordering Information	<b>HI98190</b> is supplied with HI12963 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), electrode cleaning solution sachet (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quick start guide, quality certificate and instruction manual in an HI720190 rugged carrying case with custom insert.	

\* Limits will be reduced to actual sensor limits

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HI98161

## pH / Temperature Meter for Food

HI98161 is a professional portable pH and temperature meter with a probe designed specifically for pH measurement in the Food sector.

- **Waterproof**
  - IP67 rated waterproof, rugged enclosure
- **CAL Check™**
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer and overall probe condition
- **Automatic or manual temperature compensation**
  - pH sensors incorporate a built-in temperature sensor
- **Calibration**
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- **Approximately 200 hour battery life**
  - Powered by (4) 1.5V AA batteries
- **Clear display**
  - Dot matrix display with multifunction virtual keys
- **Auto hold**
  - Automatically holds the first stable reading on the display
- **Calibration timeout**
  - Alerts when calibration is due at a specified interval
- **Connectivity**
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- **GLP**
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- **Intuitive keypad**
  - Important and often used functions such as GLP information, help, range, calibration and backlight have a dedicated button
- **Supplied complete**
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case





# Foodcare pH Meter

designed for food professionals

Hanna food quality pH meters are rugged and portable with the performance and features of a benchtop. Five models are available in this series to measure food, milk, meat, yogurt and cheese. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.



## Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

## Waterproof Protection

The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

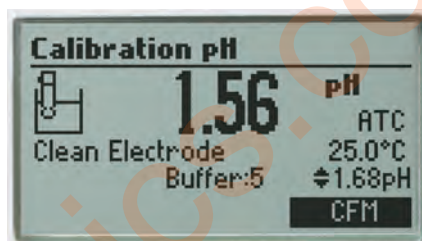


## Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

## Calibration Timeout

Alerts when calibration is due at a specified interval.



## pH Calibration

Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of  $\pm 0.002$ .

## Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.



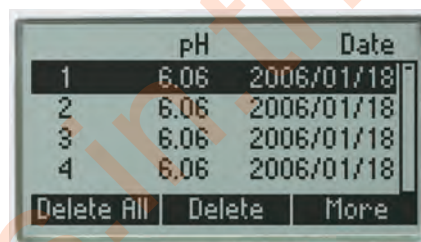
## CAL Check™

Hanna's CAL Check™ maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.



## GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time and calibration values are stored with logged data for retrieval at a later time.



## Data Logging

The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

## Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

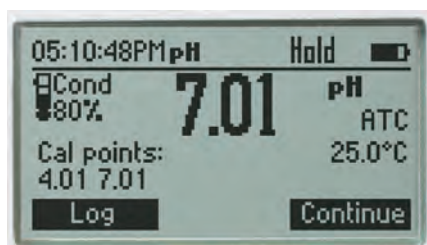
## Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.

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### Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.



### Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.



### Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units and language for help screens and guides.



### PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

### Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.



### Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

Specifications	HI98161	
pH*	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH
	Calibration	up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
	Relative mV Offset Range	±2000 mV
Temperature*	Range	-20.0 to 120.0 °C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.4°C (±0.8°F) (excluding probe error)
Additional Specifications	pH Probe	FC2023 PVDF body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable)
	Slope Calibration	from 80 to 110%
	Log-on-demand	Up to 200 samples (100 pH, 100 mV)
	PC Connection	opto-isolated USB with HI92000 software and micro USB cable
	Input Impedance	10 <sup>12</sup> Ω
	Battery Type / Life	1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight)
	Auto-off	user selectable: 5, 10, 30, 60 min, disabled
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
	Ordering Information	HI98161 is supplied with FC2023 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700641 electrode cleaning solution sachet for dairy deposits (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.

\* Limits will be reduced to actual probe/sensor limits.

## pH / Temperature Probe for Food

When measuring pH, food products can pose a number of challenges. Samples can vary in consistency from solid, semi-solid to a slurry with a high content of solids. These sample types can coat the sensitive glass membrane surface and/or clog the reference junction. Designed specifically for measuring pH in food, the FC2023 has a conic tip shape for easy penetration, an open junction to resist clogging, and a PVDF food grade plastic body that can be cleaned with sodium hypochlorite. The FC2023 is an ideal general purpose pH electrode for use in food manufacturing.

### PVDF body

Polyvinylidene fluoride (PVDF) is a food grade plastic that is resistant to most chemicals and solvents, including sodium hypochlorite. It has high abrasion resistance, mechanical strength and resistance to ultraviolet and nuclear radiation. PVDF is also resistant to fungal growth.

### Low temperature glass

The FC2023 electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC2023 is suitable to use with samples that measure from 0 to 50°C.

### Open junction reference

Clogging of the reference junction is a common challenge faced by food producers that measure pH in slurries and semi-solid products. The solids can easily clog the ceramic junction used with standard laboratory pH electrodes. The open junction design of the FC2023 resists clogging and continues to provide accurate, stable readings.

### Viscolene electrolyte

The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in food products and is maintenance-free.

### Conic tip shape

This design allows for penetration into semisolids and emulsions for the direct measurement of pH in a variety of food products including sauces, dough, and other semi-solids.

### Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.

## Application Importance

One of the most common measurements of food products is pH because of how it affects food characteristics such as shelf stability, texture, and flavor. Foods are generally broken into two groups based on their pH value. These groups include acid foods which have a naturally low pH of 4.6 or below and low-acid foods that have a finished equilibrium pH value greater than pH 4.6 and a water activity greater than 0.85. The low-acid foods can be pH adjusted with the addition of an acid to lower the final pH and become an acidified food.

In food processing, some products require the measurement of pH to meet industry regulations to ensure the quality and safety of goods. A lower pH will help in preventing unwanted bacteria from growing thus extending the shelf life of a product. While food safety is a crucial consideration, understanding the pH of a food product can also help to achieve consistent flavors and textures. Through fermentation and other biological processes, many foodstuffs only achieve their desired qualities at particular pH values or ranges. pH is an essential parameter that requires close observation throughout food production to provide the best possible product.

Specifications	FC2023
Description	pre-amplified pH/temperature probe
Reference	single, Ag/AgCl
Junction	open
Electrolyte	viscolene
Max Pressure	0.1 bar
Range	pH: 0 to 12
Recommended Operating Temperature	0 to 50°C (32 to 122°F) - LT
Tip /Shape	conic (dia: 6 x 10 mm)
Temperature Sensor	yes
Amplifier	yes
Body Material	PVDF
Cable	coaxial; 1 m (3.3')
Connection	quick connect DIN

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HI98162

## pH / Temperature Meter for Milk

HI98162 is a professional portable pH and temperature meter with a probe designed specifically for pH measurement in milk.

- **Waterproof**
  - IP67 rated waterproof, rugged enclosure
- **CAL Check™**
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer and overall probe condition
- **Automatic or manual temperature compensation**
  - pH sensors incorporate a built-in temperature sensor
- **Calibration**
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- **Approximately 200 hour battery life**
  - Powered by (4) 1.5V AA batteries
- **Clear display**
  - Dot matrix display with multifunction virtual keys
- **Auto hold**
  - Automatically holds the first stable reading on the display
- **Calibration timeout**
  - Alerts when calibration is due at a specified interval
- **Connectivity**
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- **GLP**
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- **Intuitive keypad**
  - Important and often used functions such as GLP information, help, range, calibration and backlight have a dedicated button
- **Supplied complete**
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case



# Milk pH Meter

designed for food professionals

Hanna food quality pH meters are rugged and portable with the performance and features of a benchtop. Five models are available in this series to measure food, milk, meat, yogurt and cheese. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.



## Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

## Waterproof Protection

The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.



## Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

## Calibration Timeout

Alerts when calibration is due at a specified interval.

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## pH Calibration

Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of  $\pm 0.002$ .

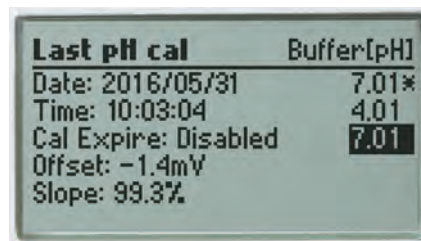
## Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.



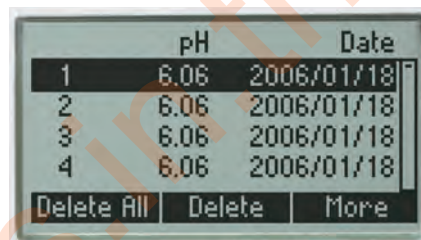
## CAL Check™

Hanna's CAL Check™ maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.



## GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time and calibration values are stored with logged data for retrieval at a later time.



## Data Logging

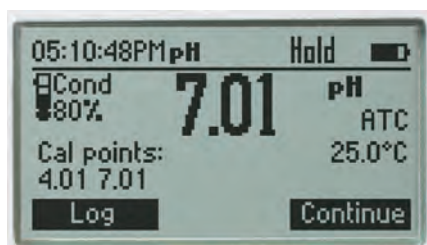
The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

## Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

## Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.



### Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.



### Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.



### Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units and language for help screens and guides.



### PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

### Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.



### Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

Specifications	HI98162	
pH*	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH
	Calibration	up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
	Relative mV Offset Range	±2000 mV
Temperature*	Range	-20.0 to 120.0 °C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.4°C (±0.8°F) (excluding probe error)
Additional Specifications	pH Probe	FC1013 PVDF body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable)
	Slope Calibration	from 80 to 110%
	Log-on-demand	Up to 200 samples (100 pH, 100 mV)
	PC Connection	opto-isolated USB with HI92000 software and micro USB cable
	Input Impedance	10 <sup>12</sup> Ω
	Battery Type / Life	1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight)
	Auto-off	user selectable: 5, 10, 30, 60 min, disabled
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
	Ordering Information	HI98162 is supplied with FC1013 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700640 electrode cleaning solution sachet for milk deposits (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.

\* Limits will be reduced to actual probe/sensor limits.

## pH / Temperature Probe for Milk

The FC1013 pH electrode has a built-in temperature sensor for simultaneous temperature compensated pH and temperature readings, and also contains an integral pH sensor preamplifier to provide measurements impervious to noise and electrical interferences.

FC1013 electrode is designed to prevent the typical problems of clogging in viscous and proteinaceous liquids ensuring a fast response and stable reading.

### PVDF body

The FC1013 is composed of food grade PVDF plastic. This material is highly durable and chemically resistant.

### General purpose glass

The FC1013 uses general purpose (GP) glass. The formulation allows for fast response over a wide range of temperatures. The FC1013 is suitable to use with samples that measure from 0 to 80°C.

### Refillable electrolyte

The silver-free electrolyte ensures no silver precipitate can clog the junction. An easy to use fill cap allows for quick refilling of electrolyte solution to maintain adequate head pressure.

### Single ceramic junction

A porous ceramic frit allows the silver-free electrolyte to flow slowly into solution, providing accurate readings for aqueous samples.

### Spheric tip shape

The shape of the sensing membrane provides a large surface area for contact with milk samples. The highly durable construction provides accurate measurements on the dairy farm as well as the production facility.

### Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH bulb. A temperature sensor should be as close as possible to the indicating pH electrode in order to compensate for variations in temperature.

Specifications	FC1013
Description	pre-amplified pH/temperature probe
Reference	double, Ag/AgCl
Junction	ceramic, single
Electrolyte	KCl 3.5M
Max Pressure	0.1 bar
Range	pH: 0 to 13
Recommended Operating Temperature	0 to 80°C (32 to 176°F) - GP
Tip / Shape	spheric (dia: 7.5 mm)
Temperature Sensor	yes
Amplifier	yes
Body Material	PVDF
Cable	coaxial; 1 m (3.3')
Connection	quick connect DIN

## Application Importance

The measurement of pH in milk is important in testing for impurities, spoilage, and signs of mastitis infection. While there are a number of factors that affect the composition of milk, pH measurements can help producers understand what might be causing certain compositional changes. pH measurements are commonly performed at various points in a milk processing plant.

Fresh milk has a pH value of 6.7. When the pH value of the milk falls below pH 6.7, it typically indicates spoilage by bacterial degradation. Bacteria from the family of Lactobacillaceae are lactic acid bacteria (LAB) responsible for the breakdown of the lactose in milk to form lactic acid. Eventually when the milk reaches an acidic enough pH, coagulation or curdling will occur along with the characteristic smell and taste of "sour" milk.

Milk with pH values higher than pH 6.7 potentially indicate that the milk may have come from cows infected with mastitis. Mastitis is an ever-present challenge with dairy milking cows. When infected, the cow's immune system releases histamine and other compounds in response to the infection. There is a resulting increase in permeability of endothelial and epithelial cell layers, allowing blood components to pass through a paracellular pathway. Since blood plasma is slightly alkaline, the resulting pH of milk will be higher than normal. Typically milk producers can perform a somatic cell count to detect a mastitis infection, but a pH measurement offers a quick way to screen for infection.

Understanding the pH of raw milk can also help producers optimize their processing techniques. For example, in operations that use Ultra High Temperature (UHT) processing, even small variations from pH 6.7 can affect the time required for pasteurization and the stability of the milk after treatment.



HI98163

## pH / Temperature Meter for Meat

HI98163 is a professional portable pH and temperature meter with a probe designed specifically for pH measurement in meat.

- **Waterproof**
  - IP67 rated waterproof, rugged enclosure
- **CAL Check™**
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer and overall probe condition
- **Automatic or manual temperature compensation**
  - pH sensors incorporate a built-in temperature sensor
- **Calibration**
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- **Approximately 200 hour battery life**
  - Powered by (4) 1.5V AA batteries
- **Clear display**
  - Dot matrix display with multifunction virtual keys
- **Auto hold**
  - Automatically holds the first stable reading on the display
- **Calibration timeout**
  - Alerts when calibration is due at a specified interval
- **Connectivity**
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- **GLP**
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- **Intuitive keypad**
  - Important and often used functions such as GLP information, help, range, calibration and backlight have a dedicated button
- **Supplied complete**
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case



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# Meat pH Meter

designed for food professionals

Hanna food quality pH meters are rugged and portable with the performance and features of a benchtop. Five models are available in this series to measure food, milk, meat, yogurt and cheese. Each model is supplied with an application specific electrode and cleaning solutions. These waterproof meters comply to IP67 standards and can be easily operated with one hand.



## Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

## Waterproof Protection

The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

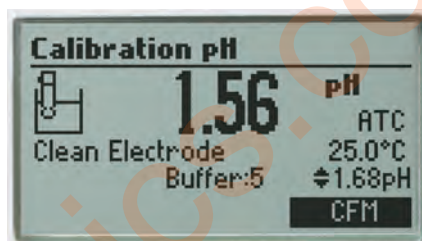


## Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

## Calibration Timeout

Alerts when calibration is due at a specified interval.



## pH Calibration

Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of  $\pm 0.002$ .

## Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.



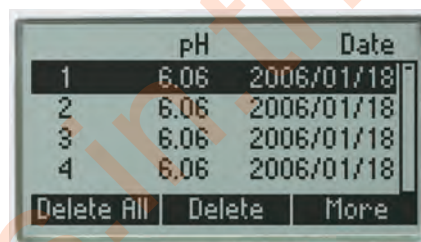
## CAL Check™

Hanna's CAL Check™ maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.



## GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time and calibration values are stored with logged data for retrieval at a later time.



## Data Logging

The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

## Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

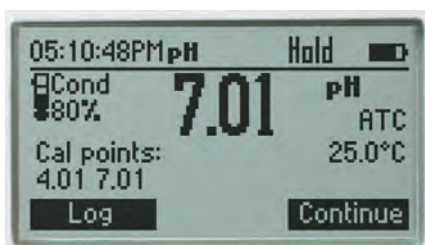
## Intuitive Keypad

The fitted rubber keypad has dedicated keys for many important and often used functions. These meters also feature two virtual soft keys that navigate the user through setup and logging of data. The interface is intuitive for any user's level of experience.

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### Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.



### Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.



### Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units and language for help screens and guides.



### PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

### Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.



### Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

Specifications	HI98163	
pH*	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH
	Calibration	up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
	Relative mV Offset Range	±2000 mV
Temperature*	Range	-20.0 to 120.0 °C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.4°C (±0.8°F) (excluding probe error)
Additional Specifications	pH Probe	FC2323 PVDF body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable)
	Slope Calibration	from 80 to 110%
	Log-on-demand	Up to 200 samples (100 pH, 100 mV)
	PC Connection	opto-isolated USB with HI92000 software and micro USB cable
	Input Impedance	10 <sup>12</sup> Ω
	Battery Type / Life	1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight)
	Auto-off	user selectable: 5, 10, 30, 60 min, disabled
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
	Ordering Information	HI98163 is supplied with FC2323 pH electrode, FC099 meat piercing stainless steel blade, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700630 electrode acid cleaning solution sachet for meat grease and fat deposits (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.

\*Limits will be reduced to actual probe/sensor limits.

## pH / Temperature Probe for Meat

The FC2323 probe has been specially designed with a stainless steel blade tip for meat penetration.

### PVDF body

Polyvinylidene fluoride (PVDF) is a food grade plastic that is resistant to most chemicals and solvents, including sodium hypochlorite. It has high abrasion resistance, mechanical strength and resistance to ultraviolet and nuclear radiation. PVDF is also resistant to fungal growth.

### Viscolene electrolyte

The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in food products and is maintenance-free.

### Stainless steel piercing blade

The FC099 (35mm; 1.38") stainless steel blade can be attached to the probe for easy meat penetration. Piercing into the meat will allow for the pH glass and reference junction to be in contact with the sample for a direct pH measurement without extensive sample preparation.

### Open junction reference

Clogging of the reference junction is a common challenge faced by food producers that measure pH in semi-solid products such as meat. The solids can easily clog the ceramic junction used with standard laboratory pH electrodes. The open junction design of the FC2323 resists clogging and continues to provide accurate, stable readings.

### Low temperature glass

The FC2023 electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC2023 is suitable to use with samples that measure from 0 to 50°C.

### Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.

### Conic tip shape

This design along with a piercing blade allows for the easy penetration into semisolids for the direct measurement of pH.



## Application Importance

In the meat production industry, the monitoring of pH is considered to be of the utmost importance due to its effect on the meat's quality factors including water binding capacity and shelf life. Upon slaughter, biochemical processes begin to break down the meat. Glycolysis begins post-mortem, converting glycogen to lactic acid, reducing the pH of the carcass. Depending on a number of factors such as type of animal and even breed, this decrease in pH can take anywhere from a single hour to many. It is vital to monitor pH during this phase as once the lowest pH value is reached, the pH will begin to slowly rise, indicating that decomposition has begun.

The pH value of meat influences its' water binding capacity which directly impacts consumer qualities such as tenderness and color. Lower pH values result in a lower water-binding capacity and lighter colors. Factors such as these can be important when considering how to efficiently produce meat products. For example, when producing dry sausages the meat must have a low water binding capacity so that it can dry evenly.

Depending on the type of the final product and the steps required to get there, pH values will vary throughout the meat processing industry. It is imperative, regardless of the final product, that pH be maintained at a low value to prevent bacterial spoilage and comply with food safety regulations. By monitoring pH values throughout the meat production process, you can ensure the creation of consistent and safe meat products.

Specifications	FC2323
Description	pre-amplified pH/temperature probe
Reference	single, Ag/AgCl
Junction	open
Electrolyte	viscolene
Max Pressure	0.1 bar
Range	pH: 0 to 12
Recommended Operating Temperature	0 to 50°C (32 to 122°F) - LT
Tip /Shape	conic (dia: 6 x 10 mm)
Temperature Sensor	yes
Amplifier	yes
Body Material	PVDF
Cable	coaxial; 1 m (3.3')
Connection	quick connect DIN

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HI98164

## pH / Temperature Meter for Yogurt

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- **Waterproof**
  - IP67 rated waterproof, rugged enclosure
- **CAL Check™**
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer and overall probe condition
- **Automatic or manual temperature compensation**
  - pH sensors incorporate a built-in temperature sensor
- **Calibration**
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- **Approximately 200 hour battery life**
  - Powered by (4) 1.5V AA batteries
- **Clear display**
  - Dot matrix display with multifunction virtual keys
- **Auto hold**
  - Automatically holds the first stable reading on the display
- **Calibration timeout**
  - Alerts when calibration is due at a specified interval
- **Connectivity**
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- **GLP**
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- **Intuitive keypad**
  - Important and often used functions such as GLP information, help, range, calibration and backlight have a dedicated button
- **Supplied complete**
  - Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case



# Yogurt pH Meter

designed for food professionals

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## Backlit Graphic LCD Display

These meters feature a backlit graphic LCD with on-screen help. The graphic display allows for the use of virtual keys to provide for an intuitive user interface.

## Waterproof Protection

The meter is enclosed in an IP67 rated waterproof casing and can withstand immersion in water at a depth of 1 m for up to 30 minutes.

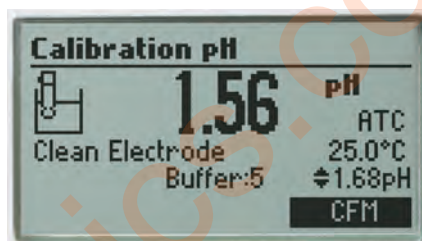


## Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

## Calibration Timeout

Alerts when calibration is due at a specified interval.



## pH Calibration

Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of  $\pm 0.002$ .

## Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.



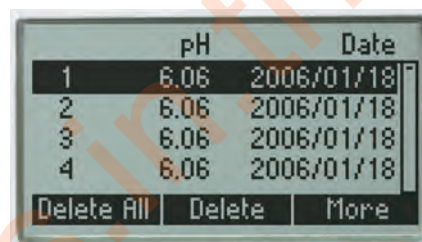
## CAL Check™

Hanna's CAL Check™ maintains a history of past calibrations and monitors the pH electrode and buffers during subsequent calibrations for any signs of wide variances due to a dirty or broken electrode or contaminated pH buffers. During calibration, users are alerted to problems should they occur. After calibration, the electrode's overall condition is displayed as a percentage.



## GLP

Comprehensive GLP functions are directly accessible by pressing the GLP key. Calibration data, including date, time and calibration values are stored with logged data for retrieval at a later time.



## Data Logging

The log-on-demand feature allows users to store up to 200 samples that can be later transferred to a PC with the HI920015 USB cable and HI92000 software.

## Automatic Temperature Compensation

pH sensors incorporate a built-in temperature sensor in the tip of the electrode for a fast and accurate temperature compensated value.

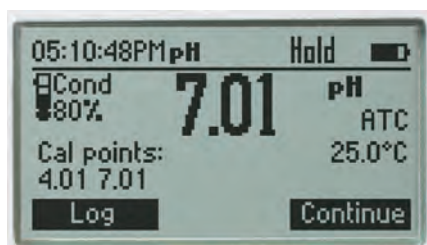
## Intuitive Keypad

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### Auto Hold

Pressing AutoEnd during measurement will automatically hold the first stable reading on the display.



### Dedicated Help Key

Contextual help is always available through a dedicated "HELP" key. Clear tutorial messages and directions are available on-screen to quickly and easily guide users through setup and calibration. The help information displayed is relative to the setting/option being viewed.



### Setup Screen

Our extensive setup screen features a host of configurable options such as time, date, temperature units and language for help screens and guides.



### PC Connectivity

Logged data can be transferred to a Windows compatible PC with the included HI920015 micro USB cable and HI92000 software.

### Long Battery Life

The display of the meter has a battery icon indicator to show the remaining power. The meter uses four 1.5V AA batteries that provide up to 200 hours of battery life.



### Supplied Complete in a Rugged Custom Carrying Case

Each meter is supplied complete with sensor, calibration and cleaning solutions, beakers, PC software and connection cable, instruction manual, quick start guide and batteries in a rugged, custom carrying case. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

Specifications	HI98164	
pH*	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH
	Calibration	up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
	Relative mV Offset Range	±2000 mV
Temperature*	Range	-20.0 to 120.0 °C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.4°C (±0.8°F) (excluding probe error)
Additional Specifications	pH Probe	FC2133 glass body, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable)
	Slope Calibration	from 80 to 110%
	Log-on-demand	Up to 200 samples (100 pH, 100 mV)
	PC Connection	opto-isolated USB with HI92000 software and micro USB cable
	Input Impedance	10 <sup>12</sup> Ω
	Battery Type / Life	1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight)
	Auto-off	user selectable: 5, 10, 30, 60 min, disabled
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
Ordering Information	<b>HI98164</b> is supplied with FC2133 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700643 electrode cleaning and disinfection solution sachet for yogurt products (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.	

\* Limits will be reduced to actual probe/sensor limits.

## pH / Temperature Probe for Yogurt

The FC2133 pH electrode is rugged and easy to clean with a conical tip and built-in temperature sensor. The open junction design consists of a solid gel interface (viscolene) between the sample and internal Ag/AgCl reference. This interface not only prevents silver from entering the sample, but also makes it impermeable to clogging after measurements in semi-solid or viscous samples. FC2133 electrode is designed to prevent the typical problems of clogging in viscous liquids, ensuring a fast response and stable reading.

### Glass body

The glass body of the FC2133 allows standards and samples to more quickly reach thermal equilibrium while also providing chemical resistance.

### Low temperature glass

The FC2133 electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC2133 is suitable to use with samples that measure from 0 to 50°C.

### Viscolene electrolyte

The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in yogurt and is maintenance-free.

### Open junction reference

Clogging of the reference junction is a common challenge faced by yogurt producers as the milk solids and proteins can easily build up on the electrode. The open junction design of the FC2133 resists clogging and continues to provide accurate, stable readings.

### Conic tip shape

This design allows for penetration into semisolids and emulsions for the direct measurement of pH in yogurt products.

### Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.

## Application Importance

Monitoring pH is crucial in producing consistent, quality yogurt. Yogurt is made by the fermentation of milk with live bacterial cultures. Following pasteurization and compositional adjustment, milk is homogenized for a consistent texture, heated to the desired thickness, and cooled before inoculation. Most yogurt is inoculated with a starter culture consisting of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Once the live culture is added, the mixture of milk and bacteria is incubated, allowing for fermentation of lactose to lactic acid. As lactic acid is produced, there is a correlating drop in pH. Due to the more acidic mixture, the casein protein in milk coagulates and precipitates out, thickening the milk into a yogurt-like texture.

Yogurt producers cease incubation once a specific pH level is reached. Most producers have a set point between pH 4.0 and 4.6 in which fermentation is stopped by rapid cooling. The amount of lactic acid present at this pH level is ideal for yogurt, giving it the characteristic tartness, aiding in thickening, and acting as a preservative against undesirable strains of bacteria.

By verifying that fermentation continues to a predetermined pH endpoint, yogurt producers can ensure their products remain consistent in terms of flavor, aroma, and texture. A deviation from the predetermined pH can lead to a reduced shelf life of yogurt or create a product that is too bitter or tart. Syneresis is the separation of liquid, in this case whey, from the milk solids; this can occur if fermentation is stopped too early or too late, resulting in yogurt that is respectively too alkaline or too acidic. Consumers expect yogurt to remain texturally consistent, so ensuring fermentation is stopped at the appropriate pH is vital to consumer perception.

Specifications	FC2133
Description	pre-amplified pH / temperature probe
Reference	double, Ag/AgCl
Junction	open
Electrolyte	viscolene
Max Pressure	0.1 bar
Range	pH: 0 to 12
Recommended Operating Temperature	0 to 50°C (32 to 122°F)
Tip / Shape	conic
Temperature Sensor	yes
Amplifier	yes
Body Material	glass
Cable	coaxial; 1 m (3.3')
Connection	quick connect DIN

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HI98165

## pH / Temperature Meter for Cheese

HI98165 is a professional portable pH and temperature meter with a probe designed specifically for pH measurement in cheese.

- **Waterproof**
  - IP67 rated waterproof, rugged enclosure
- **CAL Check™**
  - Alerts users to problems during calibration including dirty/broken electrode, contaminated buffer and overall probe condition
- **Automatic or manual temperature compensation**
  - pH sensors incorporate a built-in temperature sensor
- **Calibration**
  - Up to a five-point calibration with seven standard buffers and five custom buffers
- **Approximately 200 hour battery life**
  - Powered by (4) 1.5V AA batteries
- **Clear display**
  - Dot matrix display with multifunction virtual keys
- **Auto hold**
  - Automatically holds the first stable reading on the display
- **Calibration timeout**
  - Alerts when calibration is due at a specified interval
- **Connectivity**
  - PC connectivity via opto-isolated micro-USB with HI92000 software
- **GLP**
  - GLP data provides data from previous calibration to ensure Good Laboratory Practices are met
- **Intuitive keypad**
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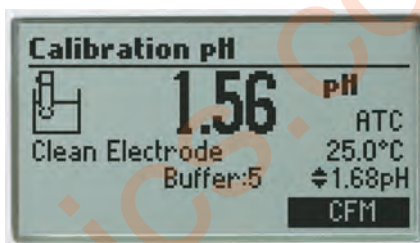


## Quick Connect Probe

Each meter features an application specific pH/temperature probe with a quick connect DIN connector to make attaching and removing the probe simple and easy.

## Calibration Timeout

Alerts when calibration is due at a specified interval.



## pH Calibration

Choose from seven standard pH buffers and five custom values to obtain up to five point calibration and achieve high precision readings with a 0.001 pH resolution and a pH accuracy of  $\pm 0.002$ .

## Enhanced Calibration

An "out of calibration range" warning can be engaged to keep the user informed of the current calibration and help to avoid performing measurements that are out of the bracketed range.



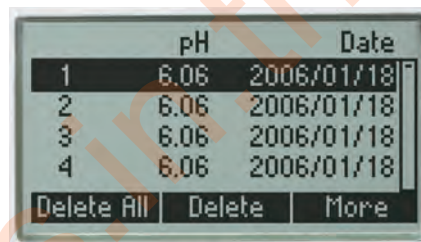
## CAL Check™

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## GLP

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## Data Logging

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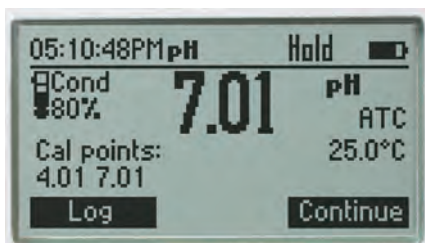
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Specifications	HI98165	
pH*	Range	-2.0 to 20.0 pH; -2.00 to 20.00 pH; -2.000 to 20.000 pH
	Resolution	0.1 pH; 0.01 pH; 0.001 pH
	Accuracy	±0.1 pH; ±0.01 pH; ±0.002 pH
	Calibration	up to five-point calibration, seven standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and five custom buffers
	Temperature Compensation	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F)
mV	Range	±2000 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV
	Relative mV Offset Range	±2000 mV
Temperature*	Range	-20.0 to 120.0 °C (-4.0 to 248.0°F)
	Resolution	0.1°C (0.1°F)
	Accuracy	±0.4°C (±0.8°F) (excluding probe error)
Additional Specifications	pH Probe	FC2423 pre-amplified pH and temperature probe with stainless steel sheath, pH electrode with internal temperature sensor, quick DIN connector and 1 m (3.3' cable)
	Slope Calibration	from 80 to 110%
	Log-on-demand	Up to 200 samples (100 pH, 100 mV)
	PC Connection	opto-isolated USB with HI92000 software and micro USB cable
	Input Impedance	10 <sup>12</sup> Ω
	Battery Type / Life	1.5V AA batteries (4) / approximately 200 hours of continuous use without backlight (50 hours with backlight)
	Auto-off	user selectable: 5, 10, 30, 60 min, disabled
	Environment	0 to 50°C (32 to 122°F); RH 100% IP67
	Dimensions / Weight	185 x 93 x 35.2 mm (7.3 x 3.6 x 1.4") / 400 g (14.2 oz.)
Ordering Information	<b>HI98165</b> is supplied with FC2423 pH electrode, HI7004M pH 4.01 buffer solution (230 mL), HI7007M pH 7.01 buffer solution (230 mL), HI700642 electrode cleaning solution sachet for cheese residues (2), 100 mL plastic beaker (2), HI92000 PC software, HI920015 micro USB cable, 1.5V AA batteries (4), quick start guide, quality certificate and instruction manual in a rugged carrying case with custom insert.	

\* Limits will be reduced to actual probe/sensor limits.

# pH / Temperature Probe for Cheese

FC2423 electrode has a stainless steel sheath and conical tip to ensure quick, easy measurements and fast response. FC2423 pH electrode features a built-in temperature sensor and is ideal for measurements in semi-solid samples such as cheeses.

## Low temperature glass

The FC2423 electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC2423 is suitable to use with samples that measure from 0 to 50°C.

## AISI 316 stainless steel body

The metal body offers durability in the production facility and can withstand chloride concentrations that cause corrosion in other types of alloys.

## Viscolene electrolyte

The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in cheese products and is maintenance-free.

## Built-in temperature sensor

A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.

## Conic tip shape

This design allows for penetration into solids, semi solids, and emulsions for the direct measurement of pH in cheese products.

Specifications	FC2423
Description	pre-amplified pH / temperature probe
Reference	single, Ag/AgCl
Junction	open
Electrolyte	viscolene
Max Pressure	0.1 bar
Range	pH: 0 to 12
Recommended Operating Temperature	0 to 50°C (32 to 122°F)
Tip / Shape	conic
Temperature Sensor	yes
Amplifier	yes
Body Material	AISI 316 stainless steel
Cable	coaxial; 1 m (3.3')
Connection	quick connect DIN

## Application Importance

pH is an essential measurement throughout the entire cheesemaking process. From the initial measurements of incoming milk to the final measurements of ripened cheese, pH is the most important parameter for cheese quality and safety control.

Acidification of milk begins with the addition of bacterial culture and rennet. The bacteria consume lactose and create lactic acid as a byproduct of fermentation, lowering the pH of the milk. Once the milk reaches a particular pH, the rennet is added. The enzymes in rennet help to speed up curdling and create a firmer substance. For cheesemakers that dilute their rennet, the pH of the dilution water is also critical; water that is near pH 7 or higher can deactivate the rennet, causing problems with coagulation.

Once the curds are cut, stirred, and cooked, the liquid whey must be drained. The pH of whey at draining directly affects the composition and texture of the final cheese product. Whey that has a relatively high pH contributes to higher levels of calcium and phosphate and results in a stronger curd. Typical pH levels at draining can vary depending on the type of cheese; for example, Swiss cheese is drained between pH 6.3 and 6.5 while Cheddar cheese is drained between pH 6.0 and 6.2.

The next stages of milling and salting are affected by pH as well. During milling, curds are cut into smaller pieces to prepare the cheese for salting. Curds with a lower pH at milling result in a harder cheese. A low pH will also result in higher salt absorption during the salting stage.

When curds are pressed into a final, solid form, the pH directly affects how well the curds fuse together. If the pH is too high during pressing, the curds will not bind together as well and the final cheese will have a more open texture.

During brining, the cheese soaks up salt from the brine solution and loses excess moisture. The pH of the brine solution should be close to the pH of the cheese, ensuring equilibrium of ions like calcium and hydrogen. If there is an imbalance during brining, the final product can have rind defects, discoloration, a weakened texture, and a shorter shelf life.

Cheeses must fall within a narrow pH range to provide an optimal environment for microbial and enzymatic processes that occur during ripening. Bacterial cultures used in ripening are responsible for characteristics like the holes in Swiss cheese, the white mold on Brie rinds, and the aroma of Limburger cheese. A deviation from the ideal pH is not only detrimental to the ecology of the bacteria, but also to the cheese structure. Higher pH levels can result in cheeses that are more elastic while lower pH levels can cause brittleness.



HI9124 · HI9125

## Portable pH/mV Meters

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Waterproof casing
- Battery Error Prevention System (BEPS)
  - Automatically shuts off meter when battery is too low to take accurate readings
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI9124 and HI9125 are portable, waterproof pH meters. The HI9125 can utilize ORP (oxidation reduction potential) electrodes and display results in the mV range.

A large dual-level LCD displays both the pH and temperature along with an operational guide. Graphic symbols are displayed to help the users during the calibration process.

The pH calibration procedure is automatic with five memorized pH buffer values.

These meters utilize the HI1230B double junction pH electrode. The double junction helps to minimize junction contamination for accurate, consistent results.



### Specifications

	HI9124	HI9125	
pH*	Range	-2.00 to 16.00 pH	-2.00 to 16.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy	±0.01 pH	±0.01 pH
	Calibration	one or two-point with five standard buffer values (pH 4.01, 6.86, 7.01, 9.18, 10.01)	one or two-point with five standard buffer values (pH 4.01, 6.86, 7.01, 9.18, 10.01)
mV	Temperature Compensation	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) without temperature probe	automatic or manual from -20.0 to 120.0°C (-4.0 to 248.0°F) without temperature probe
	Range	-	±699.9 mV; ±1999 mV
	Resolution	-	0.1 mV; 1 mV
Temperature*	Accuracy	-	±0.2 mV; ±1 mV
	Range	-20.0 to 120.0°C (-4.0°F to 248.0°F)	-20.0 to 120.0°C (-4.0°F to 248.0°F)
	Resolution	0.1°C (0.1°F)	0.1°C (0.1°F)
Additional Specifications Both All Meters	Accuracy	±0.4°C (±0.8°F)	±0.4°C (±0.8°F)
	pH Electrode	HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included)	
	Temperature Probe	HI7662 stainless steel temperature probe with 1 m (3.3') cable (included)	
	Slope / Offset Calibration	from 80 to 108% / ±1 pH	
	Input Impedance	10 <sup>12</sup> Ohm	
	Battery Type / Life	1.5V AAA (3) / approximately 200 hours of continuous use.	
	Auto-off	auto-off after 20 minutes of non-use (can be disabled)	
	Environment	0 to 50°C (32 to 122°F); RH max 100%	
	Dimensions / Weight	185 x 72 x 36 mm (7.3 x 2.8 x 1.4") / 300 g (10.6 oz.)	
	Ordering Information	HI9124 and HI9125 are supplied with HI1230B pH electrode, HI7662 temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, 100 mL plastic beaker, batteries, instructions and hard carrying case.	

\* Limits will be reduced to actual sensor limits

## pH/pH-mV/ORP and Temperature Meters



- **Sensor Check™**
  - (HI991003) Allows users to check the pH electrode status at any time
- **Automatic Temperature Compensation (ATC)**
- **Two-point calibration**
  - Up to two points automatic calibration
- **Battery Error Prevention System (BEPS)**
  - Alerts the user of low battery power that could adversely affect readings
- **Waterproof**
  - Compact, heavy-duty, and waterproof protected casing
- **Battery life indicator**
  - Battery percentage displayed on startup
- **HELP feature**
  - Tutorial messages displayed on LCD

HI991001, HI991002 and HI991003 are ideal for plating baths, wastewater, swimming pool and spa water quality and environmental applications.

HI991003 is a portable pH/pH-mV/ORP and temperature meter with our unique Sensor Check™ feature that allows the user to determine the electrode status at any time. HI991002 measures pH/ORP and temperature while the HI991001 measures pH and temperature.

The HI1296D pH/temperature and HI1297D pH/ORP/temperature probes feature an easy to clean recessed tip that prevents solids in solutions from collecting on the sensor. The titanium body of these probes function as a potential matching pin for increased stability of readings and extended sensor life.



- **Pre-amplified pH electrodes**
  - The HI1297D pH/ORP electrode and HI1296D pH electrode have an internal temperature sensor and also contain a pre-amplifier to render measurements impervious to noise and electrical interferences.

Specifications	HI991001	HI991002	HI991003
pH*	Range	-2.00 to 16.00 pH	-2.00 to 16.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy	±0.02 pH	±0.02 pH
	Calibration	automatic one or two-point calibration with two sets of standard buffers available (standard 4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)	
mV	Range	-	±1999 mV
	Resolution	-	1 mV
	Accuracy	-	±2 mV
pH-mV	Range	-	±825 mV (pH-mV)
	Resolution	-	1 mV
	Accuracy	-	±1 mV
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F	
	Resolution	0.1°C; 0.1°F	
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)	
Additional Specifications	pH Electrode (HI991003 & HI991002)	HI1297D pre-amplified pH/ORP probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)	
	pH Electrode (HI991001)	HI1296D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)	
	Temperature Compensation	automatic, -5.0 to 105.0°C (23.0 to 221.0°F)	
	Battery Type / Life	1.5V (3) AAA / approximately 1200 hours of continuous use.	
	Auto-off	auto-off after eight minutes of non-use	
	Environment	0 to 50°C (32 to 122°F); RH max. 100%	
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)	
Ordering Information	<b>HI991001</b> is supplied with HI1296D pH/ORP probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700601 electrode cleaning solution sachet (2), batteries, instructions and rugged carrying case.		
	<b>HI991002</b> and <b>HI991003</b> are supplied with HI1297D pH/ORP probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700601 electrode cleaning solution sachet (2), batteries, instructions and rugged carrying case.		

\* Limits will be reduced to actual sensor limits

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HI99121

# Direct Soil pH Meter

with Measurement Kit

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI99121 is the perfect portable pH meter for soil testing. With the HI99121 and HI1292D direct soil pre-amplified pH and temperature probe, users can test both the pH of soil directly or after preparation of a soil slurry with deionized water.

The HI1292D features a conical, rugged tip that can be directly inserted in moist or soft soil. For harder soils, the kit includes a plastic auger to perforate the ground.

- Soil preparation solution
  - For higher degrees of accuracy, or for stony ground where the electrode may be damaged, use the included HI7051M soil preparation solution



- Optional shockproof rubber boot
  - Specially designed to protect your instrument from damage or impact

HI10023 Orange  
HI10024 Blue



## Specifications

## HI99121

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
Temperature*	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
Accuracy	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
	Electrode	HI1292D glass body, pre-amplified pH electrode for soil measurement with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
Additional Specifications	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	<p><b>HI99121</b> is supplied with HI1292D pH electrode, HI721319 soil auger, HI7051M soil preparation solution, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700663 cleaning solution sachet for inorganic soil deposits, HI700664 cleaning solution sachet for organic soil deposits, 100 mL plastic beaker, batteries, instructions and a hard carrying case.</p>	

\* Limits will be reduced to actual sensor limits

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HI99131

## Portable pH Meter

for Plating Baths

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Battery life indicator
  - Battery percentage displayed on startup
- HELP feature
  - Tutorial messages displayed on LCD

HI99131 is a waterproof, portable pH and temperature meter supplied with a flat tip probe specifically designed for use in plating baths.

The HI62911D pre-amplified, double junction pH probe features a recessed flat tip that is easy to clean and prevents solids in solutions from collecting on the sensor. The titanium body of the HI62911D functions as a potential matching pin for increased stability of readings and extended sensor life.



### Specifications

### HI99131

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
Temperature*	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
Additional Specifications	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
	Electrode	HI62911D titanium body, pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
Ordering Information	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information		<b>HI99131</b> is supplied with HI62911D pH probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), batteries, instructions and hard carrying case.

\* Limits will be reduced to actual sensor limits



- Optional shockproof rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710023** Orange  
**HI710024** Blue

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HI99141

# Portable pH Meter

for Boiler and Cooling Towers

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

HI99141 is a waterproof, portable pH and temperature meter supplied with a flat tip probe specifically designed for boiler and cooling tower applications.

The HI72911D pre-amplified double junction pH probe features a flat tip sensor that is easy to clean and prevents solids in solutions from collecting on the sensor. The titanium body of the HI72911D functions as a potential matching pin for increased stability of readings and extended sensor life.



- Optional shockproof rubber boot
  - Specially designed to protect your instrument from damage or impact

HI710023 Orange  
HI710024 Blue

## Specifications

## HI99141

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
Temperature*	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
Additional Specifications	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
	Electrode	HI72911D titanium body, pre-amplified pH electrode with internal temperature sensor, DIN connector and 1 m (3.3' cable) (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
Ordering Information	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
		HI99141 is supplied with HI72911D pH probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), batteries, instructions and hard carrying case.

\*Limits will be reduced to actual sensor limits

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HI99171

## Portable pH Meter

for Leather and Paper

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI99171 is a portable, waterproof meter designed for use with leather and paper. It provides fast, accurate, direct pH measurements. The LCD features a multi-level display with on-screen tutorial messages for calibration and set-up. HI99171 utilizes a flat tip probe designed to optimize surface contact with the sample.

pH measurement of papers and cartons is important, not only in the production phase, but also in the packaging phase. The food industry, for example, will perform pH compatibility tests between the product and packaging material.

### Specifications

### HI99171

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	HI1414D glass body, pre-amplified pH electrode with flat tip, internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	<b>HI99171</b> is supplied with HI1414D flat tipped pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700680 electrode cleaning solution for cellulose deposits sachets (2), HI70960 conductive electrolyte solution for pH measurement (30 mL), batteries, instructions and hard carrying case.	



- Optional shockproof rubber boot
  - Specially designed to protect your instrument from damage or impact

**HI710023** Orange  
**HI710024** Blue

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HI99162

## pH / Temperature Meter for Milk

with Application Specific Probe

- Waterproof
- Application specific electrode
- Automatic Temperature Compensation (ATC)
- Automatic one or two-point calibration
- Multi-level LCD display
- On-screen tutorial for calibration and set up
- Stability indicator for accurate data recording
- Battery Error Prevention System
- Battery life displayed on startup
- Supplied as a complete kit

The Hanna Instruments HI99162 is a durable, waterproof, and portable pH and temperature meter designed specifically for milk analysis. Automatic calibration is done at one or two points with two sets of buffers. All calibration and measurement readings are automatically compensated for temperature variations. The split-level LCD displays both pH and temperature readings, along with indicators for reading stability, battery percentage, and calibration instructions.



### Calibrate and measure samples right in the case

Our custom carrying case features a beaker holder for calibration on the farm or production floor.



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- Temperature
  - °C and °F measurement modes



- Buffer sets
  - Calibrate to standard (pH 4.01, pH 7.01, pH 10.01) or NIST (pH 4.01, pH 6.86, pH 9.18) buffers



- Calibration prompts
  - On-screen prompts during the calibration process



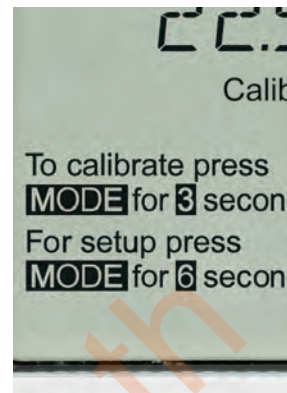
- Stability indicator
  - "Not Stable" tag disappears when the reading is stable for accurate data recording



- Freeze readings
  - Press the SET/HOLD button to hold readings on the display



- Battery percentage
  - Battery percentage is displayed at startup



- On-screen guides
  - On-screen quick guides for entering calibration and set up

Specifications	HI99162	
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	automatic, one or two-point calibration with two sets of standard buffers (standard pH 4.01, 7.01, 10.01 or NIST pH 4.01, 6.86, 9.18)
Temperature*	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
	Range	-5.0 to 105.0°C / 23.0 to 221.0°F
	Resolution	0.1°C/0.1°F
Additional Specifications	Accuracy	±0.5°C (up to 60°C); ±1.0°C (outside) / ±1°F (up to 140°F); ±2.0°F (outside)
	Probe (included)	FC101D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type/Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	auto-off after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
Ordering Information	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz)
		<b>HI99162</b> is supplied with FC101D pH probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700640 electrode cleaning solution sachets (2), batteries, instruction manual, and rugged carrying case.



### Rugged custom carrying case

The HI99162 meter, probe, and all accessories are supplied in a rugged carrying case designed to provide years of use. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

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FC101D

## pH / Temperature Probe for Milk

- PVDF body
- Spheric glass tip
- Single ceramic junction
- Double junction
- Built-in temperature sensor

- **PVDF body**
  - The FC101D is composed of food grade PVDF plastic. This material is highly durable and chemically resistant.

- **General purpose glass**
  - The FC101D uses general purpose (GP) glass. The formulation allows for fast response over a wide range of temperatures. The FC101D is suitable to use with samples that measure from 0 to 80°C.

- **Refillable electrolyte**
  - The silver-free electrolyte ensures no precipitate can clog the junction. An easy to use fill cap allows for quick refilling of electrolyte solution to maintain adequate head pressure.

- **Single ceramic junction**
  - A porous ceramic frit allows the silver-free electrolyte to flow slowly into solution, providing accurate readings for aqueous samples.

- **Built-in temperature sensor**
  - A thermistor temperature sensor is in the tip of the indicating pH bulb. A temperature sensor should be as close as possible to the indicating pH electrode in order to compensate for variations in temperature.

- **Spheric tip shape**
  - The shape of the sensing membrane provides a large surface area for contact with milk samples. The highly durable construction provides accurate measurements on the dairy farm as well as the production facility.

Specifications	FC101D
Description	pre-amplified pH/temperature probe
Reference	double, Ag/AgCl
Junction	ceramic, single
Electrolyte	KCl 3.5M
Max Pressure	0.1 bar
Range	pH: 0 to 13
Recommended Operating Temperature	0 to 80°C (32 to 176°F) - GP
Tip / Shape	spheric (dia: 7.5 mm)
Temperature Sensor	yes
Amplifier	yes
Body Material	PVDF
Cable	coaxial; 1 m (3.3')
Connection	DIN

## Application Importance

The measurement of pH in milk is important in testing for impurities, spoilage, and signs of mastitis infection. While there are a number of factors that affect the composition of milk, pH measurements can help producers understand what might be causing certain compositional changes. pH measurements are commonly performed at various points in a milk processing plant.

Fresh milk has a pH value of 6.7. When the pH value of the milk falls below pH 6.7, it typically indicates spoilage by bacterial degradation. Bacteria from the family of Lactobacillaceae are lactic acid bacteria (LAB) responsible for the breakdown of the lactose in milk to form lactic acid. Eventually when the milk reaches an acidic enough pH, coagulation or curdling will occur along with the characteristic smell and taste of "sour" milk.

Milk with pH values higher than pH 6.7 potentially indicate that the milk may have

come from cows infected with mastitis. Mastitis is an ever-present challenge with dairy milking cows. When infected, the cow's immune system releases histamine and other compounds in response to the infection. There is a resulting increase in permeability of endothelial and epithelial cell layers, allowing blood components to pass through a paracellular pathway. Since blood plasma is slightly alkaline, the resulting pH of milk will be higher than normal. Typically milk producers can perform a somatic cell count to detect a mastitis infection, but a pH measurement offers a quick way to screen for infection.

Understanding the pH of raw milk can also help producers optimize their processing techniques. For example, in operations that use Ultra High Temperature (UHT) processing, even small variations from pH 6.7 can affect the time required for pasteurization and the stability of the milk after treatment.

HI99164

## pH / Temperature Meter for Yogurt

with Application Specific Probe

- Waterproof
- Application specific electrode
- Automatic Temperature Compensation (ATC)
- Automatic one or two-point calibration
- Multi-level LCD display
- On-screen tutorial for calibration and set up
- Stability indicator for accurate data recording
- Battery Error Prevention System
- Battery life displayed on startup
- Supplied as a complete kit

The Hanna Instruments HI99164 is a durable, waterproof, and portable pH and temperature meter designed specifically for yogurt analysis. Automatic calibration is done at one or two points with two sets of buffers. All calibration and measurement readings are automatically compensated for temperature measurements. The split-level LCD displays both pH and temperature readings, along with indicators for reading stability, battery percentage, and calibration instructions.



### Calibrate and measure samples right in the case

Our custom carrying case features a beaker holder for calibration on the production floor.





- Temperature
  - °C and °F measurement modes



- Buffer sets
  - Calibrate to standard (pH 4.01, pH 7.01, pH 10.01) or NIST (pH 4.01, pH 6.86, pH 9.18) buffers



- Calibration prompts
  - On-screen prompts during the calibration process



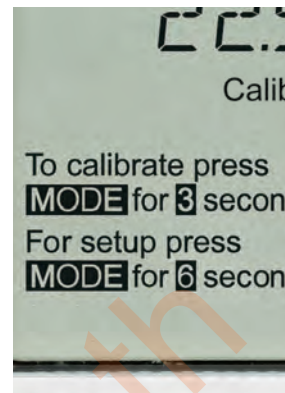
- Stability indicator
  - "Not Stable" tag disappears when the reading is stable for accurate data recording



- Freeze readings
  - Press the SET/HOLD button to hold readings on the display



- Battery percentage
  - Battery percentage is displayed at startup



- On-screen guides
  - On-screen quick guides for entering calibration and set up

Specifications	HI99164	
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	automatic, one or two-point calibration with two sets of standard buffers (standard pH 4.01, 7.01, 10.01 or NIST pH 4.01, 6.86, 9.18)
Temperature*	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
	Range	-5.0 to 105.0°C / 23.0 to 221.0°F
	Resolution	0.1°C/0.1°F
Additional Specifications	Accuracy	±0.5°C (up to 60°C); ±1.0°C (outside) / ±1°F (up to 140°F); ±2.0°F (outside)
	Probe (included)	FC213D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type/Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	auto-off after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz)	
Ordering Information	HI99164 is supplied with FC213D pH probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700643 electrode cleaning solution sachets (2), batteries, instruction manual, and rugged carrying case.	



### Rugged custom carrying case

The HI99164 meter, probe, and all accessories are supplied in a rugged carrying case designed to provide years of use. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

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\* Limits will be reduced to actual sensor limits

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FC213D

## pH / Temperature Probe for Yogurt

- Glass body
- Conic glass tip
- Low temperature glass
- Open Junction reference
- Built-in temperature sensor

- **Glass body**
  - The glass body of the FC213D allows standards and samples to more quickly reach thermal equilibrium while also providing chemical resistance.
- **Low temperature glass**
  - The FC213D electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC213D is suitable to use with samples that measure from 0 to 50°C.



- **Viscolene electrolyte**
  - The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in yogurt and is maintenance-free.
- **Open junction reference**
  - Clogging of the reference junction is a common challenge faced by yogurt producers as the milk solids and proteins can easily build up on the electrode. The open junction design of the FC213D resists clogging and continues to provide accurate, stable readings.
- **Built-in temperature sensor**
  - A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.
- **Conic tip shape**
  - This design allows for penetration into semisolids and emulsions for the direct measurement of pH in yogurt products.

Specifications	FC213D
Description	pre-amplified pH / temperature probe
Reference	double
Junction	open
Electrolyte	viscolene
Max Pressure	0.1 bar
Range	pH: 0 to 12
Recommended Operating Temperature	0 to 50°C (32 to 122°F)
Tip / Shape	conic
Temperature Sensor	yes
Amplifier	yes
Body Material	glass
Cable	coaxial; 1 m (3.3')
Connection	DIN



## Application Importance

Monitoring pH is crucial in producing consistent, quality yogurt. Yogurt is made by the fermentation of milk with live bacterial cultures. Following pasteurization and compositional adjustment, milk is homogenized for a consistent texture, heated to the desired thickness, and cooled before inoculation. Most yogurt is inoculated with a starter culture consisting of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Once the live culture is added, the mixture of milk and bacteria is incubated, allowing for fermentation of lactose to lactic acid. As lactic acid is produced, there is a correlating drop in pH. Due to the more acidic mixture, the casein protein in milk coagulates and precipitates out, thickening the milk into a yogurt-like texture.

Yogurt producers cease incubation once a specific pH level is reached. Most producers have a set point between pH 4.0 and 4.6 in which fermentation is stopped by rapid

cooling. The amount of lactic acid present at this pH level is ideal for yogurt, giving it the characteristic tartness, aiding in thickening, and acting as a preservative against undesirable strains of bacteria.

By verifying that fermentation continues to a predetermined pH endpoint, yogurt producers can ensure their products remain consistent in terms of flavor, aroma, and texture. A deviation from the predetermined pH can lead to a reduced shelf life of yogurt or create a product that is too bitter or tart. Syneresis is the separation of liquid, in this case whey, from the milk solids; this can occur if fermentation is stopped too early or too late, resulting in yogurt that is respectively too alkaline or too acidic. Consumers expect yogurt to remain texturally consistent, so ensuring fermentation is stopped at the appropriate pH is vital to consumer perception.



HI99165

## pH / Temperature Meter for Cheese

with Application Specific Probe

- Waterproof
- Application specific electrode
- Automatic Temperature Compensation (ATC)
- Automatic one or two-point calibration
- Multi-level LCD display
- On-screen tutorial for calibration and set up
- Stability indicator for accurate data recording
- Battery Error Prevention System
- Battery life displayed on startup
- Supplied as a complete kit

The Hanna Instruments HI99165 is a durable, waterproof, and portable pH and temperature meter designed specifically for cheese analysis. Automatic calibration is done at one or two points with two sets of buffers. All calibration and measurement readings are automatically compensated for temperature measurements. The split-level LCD displays both pH and temperature readings, along with indicators for reading stability, battery percentage, and calibration instructions.



### Calibrate samples right in the case

Our custom carrying case features a beaker holder for calibration on the production floor.

pH

portable



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- **Temperature**
  - °C and °F measurement modes



- **Buffer sets**
  - Calibrate to standard (pH 4.01, pH 7.01, pH 10.01) or NIST (pH 4.01, pH 6.86, pH 9.18) buffers



- **Calibration prompts**
  - On-screen prompts during the calibration process



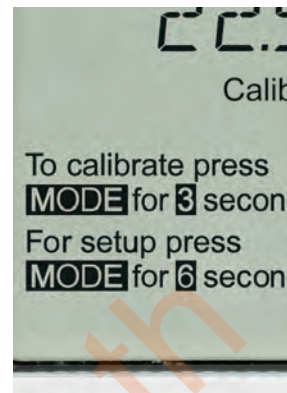
- **Stability indicator**
  - "Not Stable" tag disappears when the reading is stable for accurate data recording



- **Freeze readings**
  - Press the SET/HOLD button to hold readings on the display



- **Battery percentage**
  - Battery percentage is displayed at startup



- **On-screen guides**
  - On-screen quick guides for entering calibration and set up

Specifications	HI99165	
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	automatic, one or two-point calibration with two sets of standard buffers (standard pH 4.01, 7.01, 10.01 or NIST pH 4.01, 6.86, 9.18)
Temperature*	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
	Range	-5.0 to 105.0°C / 23.0 to 221.0°F
	Resolution	0.1°C/0.1°F
Additional Specifications	Accuracy	±0.5°C (up to 60°C); ±1.0°C (outside) / ±1°F (up to 140°F); ±2.0°F (outside)
	Probe (included)	FC242D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type/Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	auto-off after 8 minutes of non-use
Ordering Information	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz)
<p><b>HI99165</b> is supplied with FC242D pH probe with internal temperature sensor, HI70004 pH 4.01 buffer sachet, HI70007 pH 7.01 buffer sachet, HI700642 electrode cleaning solution sachets (2), batteries, instruction manual, and rugged carrying case.</p>		



### Rugged custom carrying case

The HI99165 meter, probe, and all accessories are supplied in a rugged carrying case designed to provide years of use. The inside compartment of the carrying case is thermoformed to securely hold and protect all of the components.

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\* Limits will be reduced to actual sensor limits

## pH / Temperature Probe for Cheese

- Stainless steel body
- Conic glass tip
- Low temperature glass
- Built-in temperature sensor

- **AISI 316 stainless steel body**
  - The metal body offers durability in the production facility and can withstand chloride concentrations that cause corrosion in other types of alloys.

- **Low temperature glass**
  - The FC242D electrode uses Low Temperature (LT) glass for the sensing bulb. The LT glass tip is a lower resistance glass formulation. As the temperature of the sensing glass decreases, the resistance of the LT glass will increase approaching that of standard glass at ambient temperatures. The FC242D is suitable to use with samples that measure from 0 to 50°C.



- **Viscolene electrolyte**
  - The viscolene electrolyte offers a hard gel interface between the inner electrode components and the sample being measured. The electrolyte is silver-free for use in cheese products and is maintenance-free.

- **Built-in temperature sensor**
  - A thermistor temperature sensor is in the tip of the indicating pH electrode. A temperature sensor should be as close as possible to the indicating pH bulb in order to compensate for variations in temperature.

- **Conic tip shape**
  - This design allows for penetration into solids, semi solids, and emulsions for the direct measurement of pH in cheese products.

Specifications	FC242D
Description	pre-amplified pH / temperature probe
Reference	single
Junction	ceramic
Electrolyte	viscolene
Max Pressure	0.1 bar
Range	pH: 0 to 12
Recommended Operating Temperature	0 to 50°C (32 to 122°F)
Tip /Shape	conic
Temperature Sensor	yes
Amplifier	yes
Body Material	AISI 316 stainless steel
Cable	coaxial; 1 m (3.3')
Connection	DIN

## Application Importance

pH is an essential measurement throughout the entire cheesemaking process. From the initial measurements of incoming milk to the final measurements of ripened cheese, pH is the most important parameter for cheese quality and safety control.

Acidification of milk begins with the addition of bacterial culture and rennet. The bacteria consume lactose and create lactic acid as a byproduct of fermentation, lowering the pH of the milk. Once the milk reaches a particular pH, the rennet is added. The enzymes in rennet help to speed up curdling and create a firmer substance. For cheesemakers that dilute their rennet, the pH of the dilution water is also critical; water that is near pH 7 or higher can deactivate the rennet, causing problems with coagulation.

Once the curds are cut, stirred, and cooked, the liquid whey must be drained. The pH of whey at draining directly affects the composition and texture of the final cheese product. Whey that has a relatively high pH contributes to higher levels of calcium and phosphate and results in a stronger curd. Typical pH levels at draining can vary depending on the type of cheese; for example, Swiss cheese is drained between pH 6.3 and 6.5 while Cheddar cheese is drained between pH 6.0 and 6.2.

The next stages of milling and salting are affected by pH as well. During milling, curds

are cut into smaller pieces to prepare the cheese for salting. Curds with a lower pH at milling result in a harder cheese. A low pH will also result in higher salt absorption during the salting stage.

When curds are pressed into a final, solid form, the pH directly affects how well the curds fuse together. If the pH is too high during pressing, the curds will not bind together as well and the final cheese will have a more open texture.

During brining, the cheese soaks up salt from the brine solution and loses excess moisture. The pH of the brine solution should be close to the pH of the cheese, ensuring equilibrium of ions like calcium and hydrogen. If there is an imbalance during brining, the final product can have rind defects, discoloration, a weakened texture, and a shorter shelf life.

Cheeses must fall within a narrow pH range to provide an optimal environment for microbial and enzymatic processes that occur during ripening. Bacterial cultures used in ripening are responsible for characteristics like the holes in Swiss cheese, the white mold on Brie rinds, and the aroma of Limburger cheese. A deviation from the ideal pH is not only detrimental to the ecology of the bacteria, but also to the cheese structure. Higher pH levels can result in cheeses that are more elastic while lower pH levels can cause brittleness.

# Portable pH Meter

for Food and Dairy

- For HACCP compliant testing
- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI99161 is a portable pH and temperature meter is designed specifically for dairy applications. Monitoring pH in the dairy process is critical to ensure the quality of product is upheld.

The FC202D pH electrode features a rugged, easy to clean PVDF body with a conical tip making it ideal for measurements in semi-solids such as meats and cheeses. The FC202D uses a free diffusion sleeve type reference junction which prevents the typical problems of clogging in viscous liquids such as milk or condiments.

- **Specialized electrode**
  - The FC202D is the ideal electrode to measure the pH of milk, yogurt, meats, cheeses, fruit, sushi, rice, jams, jellies, dough, ice cream, yogurt, beverages and juice



- **Optional shockproof rubber boot**
  - Specially designed to protect your instrument from damage or impact

HI710023 Orange  
HI710024 Blue



## Specifications

	HI99161	
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
Temperature*	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
Additional Specifications	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
	Electrode	FC202D PVDF body, pre-amplified pH electrode with conical tip, internal temperature sensor, DIN connector and 1 m (3.3') cable (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
Ordering Information	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
<p><b>HI99161</b> is supplied with FC202D pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700642 electrode cleaning solution sachets (2), batteries, instructions and hard carrying case.</p>		

\* Limits will be reduced to actual sensor limits

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HI99163

## Portable pH Meter

and Sensor for Meat

- For HACCP compliant testing
- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

HI99163 is a portable pH and temperature meter specially designed for the meat processing industry.

The FC232D pre-amplified pH electrode and removable stainless steel blade enables users to perform non-intrusive measurements of meat products inside and out. The free diffusion junction helps to avoid a clogged reference, where the external body material is non-toxic and food compatible.

- Two blade lengths available
  - Use the optional FC098 (20 mm) or the included FC099 (35 mm) stainless steel penetration blades for meat processing applications



- Optional shockproof rubber boot
  - Specially designed to protect your instrument from damage or impact

HI710023 Orange  
HI710024 Blue



### Specifications

### HI99163

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	FC232D pre-amplified pH probe with internal temperature sensor, DIN connector and 1 m (3.3' cable)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	<p><b>HI99163</b> is supplied with FC232D pH and temperature probe with FC099 stainless steel blade tip, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700630 electrode acid cleaning solution sachets for meat, grease and fats (2), batteries, instructions and hard carrying case.</p>	

\* Limits will be reduced to actual sensor limits

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HI99192

## Portable pH Meter

for Drinking Water

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The Hanna HI99192 is a waterproof portable pH and temperature meter designed specifically for measuring the pH of drinking water.

The HI99192 measures pH from -2.00 to 16.00 pH and temperature from -5.0 to 105.0 °C (23.0 to 221.0 °F). Automatic calibration is performed at one or two points and all readings are automatically compensated. Indicators for stability, battery percentage, and calibration instructions are viewed on the LCD display. The HI99192 uses three 1.5V AAA batteries for an exceptional battery life of 1200 hours of continuous use.







## FC215D Amplified pH Electrode

- Built-in temperature sensor
  - For automatic compensation of temperature variations
- Refillable pH electrode
- Amplified electrode
  - For fast, stable response that is immune to electrical noise due to humidity
- Triple ceramic junction design

The HI99192 drinking water pH meter uses the glass body FC215D amplified pH electrode. The amplified electrode provides a fast stable response that is immune to electrical noise due to humidity. The electrode contains an internal temperature probe to allow for automatic compensation for any variances in temperature. The electrolyte solution in the electrode is refillable.

An integral part of any pH electrode is the reference junction. The reference junction is a part of the electrode that allows for the flow of ions located in the reference cell into the sample being measured. The ions provide for an electrical connection between the reference electrode and the indicating electrode. A standard pH electrode will use a single ceramic junction that allows for 15 to 20  $\mu\text{L}$ /hour of electrolyte to flow. The FC215D has three ceramic junctions providing for 40 to 50  $\mu\text{L}$ /hour of electrolyte to flow. This increased flow provides a greater continuity between the reference electrode and the indicating electrode, making it suitable for water of low ionic strength. To optimize the flow from the electrode, the refill cap should be unscrewed; this allows for positive head pressure to be created, allowing for the electrolyte to flow more easily into the sample.

## The pH of Drinking Water

The pH of drinking water is a vital measurement. If the pH is too low, or acidic, the water will be corrosive to the distribution system and water pipes in homes. The pH of water also influences other properties including taste, odor, clarity, and efficiency of disinfection efficiency. In the United States, the pH of water is determined by a pH meter according to EPA method 150.1 and Standard Methods 4500-H.

Most drinking water plants use surface water (lakes, rivers, and streams) or groundwater as their point source. Surface water is typically lower in mineral content, which results in lower EC/TDS readings. Groundwater that has percolated through limestone, dolomite or gypsum will have a relatively higher mineral content. Depending on location, there are sources of groundwater that can be very low in mineral content.

Measuring the pH of water that is low in minerals can be difficult. The lower the mineral content the less conductive the water will be. Low conductivity water presents a challenge since the pH meter is an electrochemical system that relies on the solution being measured to be conductive. The HI99192 uses the FC215D amplified pH electrode. The FC215D has three ceramic junctions in the outer reference cell that allows for pH measurement in low conductivity solutions.

Specifications	HI99192	
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	$\pm 0.02$ pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	$\pm 0.5^\circ\text{C}$ (up to 60°C), $\pm 1.0^\circ\text{C}$ (outside); $\pm 1.0^\circ\text{F}$ (up to 140°F), $\pm 2.0^\circ\text{F}$ (outside)
Additional Specifications	Electrode	FC215D pre-amplified pH electrode with internal temperature sensor, DIN connector, 1 m (3.3') cable (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	HI99192 is supplied with FC215D pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700661 electrode cleaning solution sachets (2), HI7082 3.5 KCl filling solution, batteries, instructions and hard carrying case.	

\* Limits will be reduced to actual sensor limits

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HI99151

## Portable pH Meter

for Beer Analysis

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI99151 is a rugged, waterproof, portable pH and temperature meter designed specifically for the brewing industry. The HI99151 uses the FC214D, a titanium bodied, gel filled pH electrode that features high temperature glass and an extendable cloth junction.

The HI99151 measures pH from -2.00 to 16.00 pH and temperature from -5.0 to 105.0 °C (23.0 to 221.0 °F). Automatic calibration is done at one or two points with two sets of buffers and all readings are automatically compensated for temperature variations. Indicators for stability, battery percentage, and calibration instructions are viewed on the primary display. The HI99151 uses three 1.5V AAA batteries for an exceptional battery life of 1200 hours of continuous use.





## The Effects of pH in Brewing

In the brewing process, the enzymes required to convert starch into sugar are pH-sensitive, with an optimal pH of 5.2 to 5.6. Different compounds are used to adjust the pH including phosphoric acid, lactic acid and gypsum.

Wort clarity and break formation are also affected by pH. Protein coagulation occurs during wort boiling, where the optimum pH is around pH 4.9, though a common boil pH is pH 5.2. A pH that is too high will not only inhibit coagulation, but also promote browning due to the interaction of amino acids and reducing sugars.

Hop utilization during the wort boil is also affected by pH; as pH increases, the solubility of hop resins increase. A high pH also increases the release of tannins, resulting in a harsher taste, and tends to favor elevated microbial activity.

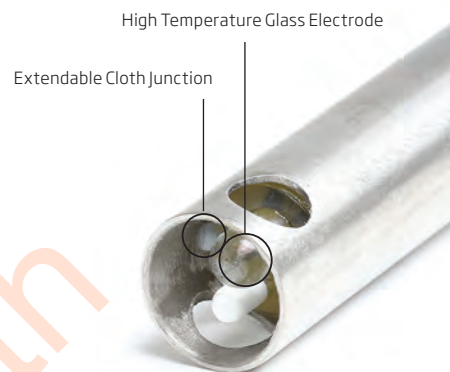
Specifications	HI99151	
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	FC214D pre-amplified pH electrode with internal temperature sensor, DIN connector, 1 m (3.3') cable (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	<b>HI99151</b> is supplied with FC214D pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700661 electrode cleaning solution sachets (2), batteries, instructions and hard carrying case.	

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## FC214D Amplified pH Electrode

- **Amplified electrode**
  - Provides a fast, stable response that is immune to electrical noise due to static discharge
- **Maintenance free gel filled electrode**
  - No fill solution required
- **Highly durable titanium body**
- **Extendable cloth junction to prevent clogging**
- **High temperature glass**

The HI99151 beer pH meter uses the titanium bodied FC214D amplified pH electrode with built-in temperature sensor. The amplified electrode provides a fast, stable response that is immune to electrical noise due to static discharge. The body of the electrode is made from titanium, which provides an unbreakable structure that allows the transfer of heat to the internal temperature sensor for rapid temperature compensation.

An integral part of any pH electrode is the reference junction. The reference junction is a part of the electrode that allows for the flow of ions located in the reference cell into the sample being measured. It is vital that this flow occurs in order to complete an electrical circuit. Any clogging of the reference junction will prevent the circuit from being completed and will result in readings that are erratic and/or constantly drifting. A typical pH electrode has a junction made of ceramic material. This ceramic material can be easily clogged by samples, such as mash with a high solids content or wort that is viscous. With the cloth junction it is possible to clear the junction by simply extracting 1/8" of the junction from the electrode. This exposes a new portion, resulting in a renewed junction.

HI99111

## Portable pH Meter

for Wine Analysis

- Clogging prevention system (CPS™)
- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI99111 is a portable, waterproof pH and temperature meter designed specifically for the wine industry. The HI99111 uses the HI1048D glass bodied pH electrode. Hanna's Clogging Prevention System (CPS™) utilizes the electrodes PTFE sleeve.

HI99111 measures pH from -2.00 to 16.00 and temperature from -5.0 to 105.0 °C (23.0 to 221.0 °F). Automatic calibration is performed at one or two points with two sets of buffers and all readings are automatically temperature compensated. Indicators for stability, battery percentage, and calibration instructions are viewed on the primary display. The HI99111 uses three 1.5V AAA batteries for an exceptional battery life of 1200 hours of continuous use.





## The Importance of pH in Wine Making

The pH of wine is important to determine because it will affect the quality of the final product in terms of taste, color, oxidation, chemical stability and other factors. Generally in winemaking, the higher the pH reading, the lower amount of acidity in the wine. Three important factors in determining the pH of wine include the ratio of malic acid to tartaric acid, the amount of potassium, and the total amount of acid present.

Most wines optimally have a pH between 2.9 and 4.0, with values differing based on the type of wine. Values above pH 4.0 indicate that the wine may spoil quickly and be chemically unstable. Lower pH values allow the wine to stay fresher for a longer period and retain its original color and flavor. High pH wine is more likely to breed bacteria and become unsuitable to drink.

For finished white wines, the ideal pH is between pH 3.00 and pH 3.30, while the final pH for red wine is ideally between pH 3.40 and pH 3.50. The optimal pH before the fermentation process is between pH 2.9 and pH 4.0. The pH of wine therefore not only affects the color of wine, but also the oxidation, yeast fermentation, protein stability, and bacterial growth and fermentation.

## HI1048D pH electrode

- PTFE sleeve
- Refillable pH electrode
- Clogging prevention system (CPS™)

The HI99111 portable pH meter for wine uses the glass body HI1048D pH electrode with Hanna's unique Clogging Prevention System (CPS™). This electrode provides a fast stable response and resists clogging. The electrolyte solution in the electrode is refillable.

An integral part of any pH electrode is the reference junction. The reference junction is a part of the electrode that allows for the flow of ions located in the reference cell into the sample being measured. The ions provide for an electrical connection between the reference electrode and the indicating electrode. A standard pH electrode will use a single ceramic junction; however, the CPS™ (Clogging Prevention System) is an innovation in electrode technology. Conventional pH electrodes use ceramic junctions that clog quickly when used in wine. When the junction is clogged, the electrode does not function. CPS™ technology utilizes the porousness of ground glass coupled with a PTFE sleeve to prevent clogging of the junction. The ground glass allows proper flow of the liquid, while the PTFE sleeve repels dirt. As a result, pH electrodes with CPS™ stay fresh up to 20 times longer than conventional electrodes.

To optimize the flow from the electrode the refill cap should be unscrewed so that it is open. This allows for positive head pressure to be created allowing for the electrolyte to drain more easily from the reference electrode.

Specifications	HI99111	
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (3.00, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	HI1048D pH/temperature probe with CPS™ technology, DIN connector, 1 m (3.3') cable (included)
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
Ordering Information	HI99111 is supplied with HI1048D pH and temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700635 electrode cleaning solution sachet for wine deposits and HI700636 electrode cleaning solution sachet for wine stains, batteries, instructions and hard carrying case.	

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# Portable pH Meter

for Skin

- Automatic Temperature Compensation (ATC)
- Two-point calibration
- Battery Error Prevention System (BEPS)
  - Alerts the user of low battery power that could adversely affect readings
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery life indicator
  - Battery percentage displayed on startup
- Help feature
  - Tutorial messages displayed on LCD

The HI99181 is a pH meter specifically designed for the analysis of skin. Essential for labs researching the biological compatibility of cosmetics and pharmaceuticals, the HI99181 provides quick and simple measurements without compromising precision.

The pre-amplified HI1414D/50 probe has been specially designed with a flat tip for accurate skin pH measurement with maximum surface contact. It is easy to clean and maintain.



- Optional shockproof rubber boot
  - Specially designed to protect your instrument from damage or impact

HI710023 Orange  
HI710024 Blue

## Specifications

## HI99181

pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.02 pH
	Calibration	one or two-point calibration, two sets of standard buffers available (4.01, 7.01, 10.01 or NIST 4.01, 6.86, 9.18)
	Temperature Compensation	automatic from -5.0 to 105.0°C (23 to 221°F)
Temperature*	Range	-5.0 to 105.0°C; 23.0 to 221.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.5°C (up to 60°C), ±1.0°C (outside); ±1.0°F (up to 140°F), ±2.0°F (outside)
Additional Specifications	Electrode	HI1414D/50 glass body, pre-amplified pH electrode with flat tip, internal temperature sensor, DIN connector and 1 m (3.3') cable
	Battery Type / Life	1.5V AAA (3) / approximately 1200 hours of continuous use
	Auto-off	after 8 minutes of non-use
	Environment	0 to 50°C (32 to 122°F); RH max. 100%
	Dimensions / Weight	152 x 58 x 30 mm (6.0 x 2.3 x 1.2") / 205 g (7.2 oz.)
	Ordering Information	HI99181 is supplied with HI1414D/50 flat tipped pH/temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700620 electrode cleaning and disinfection solution for skin residuals sachets (2), HI700621 electrode cleaning solution for skin grease and sebum sachets (2), batteries, instructions and hard carrying case.

\* Limits will be reduced to actual sensor limits

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HI8424

## General Purpose pH/mV Meter

- Automatic Temperature Compensation (ATC)
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Two-point calibration
  - Automatic one or two-point calibration
- Hold
  - HOLD function
- Battery indicator
  - Low battery indicator

The HI8424 is a highly accurate, portable pH/mV meter. It is one of the most popular pH meters on the market. This instrument is able to perform pH, mV and temperature measurements with a high degree of accuracy and fast response.

Calibration is automatic at one or two points, with three memorized buffer values (pH 4.01, pH 7.01 and pH 10.01). Once the instrument has been calibrated, the buffer values used during calibration are displayed with tags on the LCD. This feature keeps users informed of the current calibration and helps to avoid taking measurements that are out of range.

Users can exchange the pH probe for an ORP probe to obtain ORP readings in the mV range. The HI8424 also offers measurements in °C and °F and has an auto-off feature to preserve battery life.



### Specifications

### HI8424

Specifications	HI8424	
pH*	Range	-2.00 to 16.00 pH
	Resolution	0.01 pH
	Accuracy	±0.01 pH
	Calibration	one or two-point, three standard buffers available (4.01, 7.01, 10.01)
	Temperature Compensation	automatic from -20.0 to 120.0°C (-4.0 to 248.0°F) or manual without temperature probe
mV	Range	±699.9 mV; ±1999 mV
	Resolution	0.1 mV; 1 mV
	Accuracy	±0.2 mV; ±1 mV
Temperature*	Range	-20.0 to 120.0°C; -4.0 to 248.0°F
	Resolution	0.1°C; 0.1°F
	Accuracy	±0.4°C; ±0.8°F
Additional Specifications	pH Electrode	HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included)
	Temperature Probe	HI7662 stainless steel temperatures probe with 1 m (3.3') cable (included)
	Slope / Offset Calibration	from 75 to 110% / ±1 pH
	Input Impedance	10 <sup>12</sup> Ohm
	Battery Type / Life	9V / approximately 150 hours of continuous use
	Auto-off	after 20 minutes of non-use (can be disabled)
	Environment	0 to 50°C (32 to 122°F); RH max 100%
	Dimensions / Weight	164 x 76 x 45 mm (6.5 x 3.0 x 1.8") / 180 g (6.3 oz.)
Ordering Information	<b>HI8424</b> is supplied with HI1230B pH electrode, HI7662 temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), battery, protective case and instructions.	

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# Analog pH/mV Meters

- Automatic Temperature Compensation (ATC)
- Two-point Calibration
- Waterproof
  - Compact, heavy-duty, and waterproof protected casing
- Battery indicator
  - Low battery indicator

The HI83141 and HI8314 are portable pH/mV meters designed to be accurate, reliable and easy to use.

The HI8314 uses the HI1217D pre-amplified pH electrode with built-in internal temperature sensor.

The HI83141 uses the HI1230B pH electrode and HI7669AW temperature probe using separate connections.

Manual calibration is performed at one or two points by adjusting the trimmers on the front panel. Capable of measuring pH/mV and °C, these meters are great for field work, providing one meter for multiple uses.

This instrument is ideal for applications that require a custom calibration point. Manual calibration can be extremely useful in order to achieve better accuracy.

These meters can also be used for ORP measurements with the optional probes below:

HI83141: **HI3131B**

HI8314: **HI3618D** or **HI4619D**



## Specifications

		HI83141	HI8314
pH*	Range	0.00 to 14.00 pH	0.00 to 14.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy	±0.01 pH	±0.01 pH
	Calibration	manual, two-point, via trimmers	
	Temperature Compensation	automatic, 0 to 70°C (32 to 158 °F)	
mV	Range	±1999 mV	±1999 mV
	Resolution	1 mV	1 mV
	Accuracy	±1 mV	±1 mV
Temperature*	Range	0.0 to 100.0°C	0.0 to 100.0°C
	Resolution	0.1°C	0.1°C
	Accuracy	±0.4°C	±0.4°C
Additional Specifications	pH Electrode	HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included)	HI1217D PEI body, pre-amplified pH electrode with internal temperature sensor, DIN connector and 1 m cable (included)
	Temperature Probe	HI7669AW stainless steel temperature probe, BNC connector (included)	–
	Slope/Offset Calibration	from 80 to 110%/±1 pH	
	Input Impedance	10 <sup>12</sup> Ohm	
	Battery Type / Life	9V / approximately 100 hours of continuous use	
	Environment	0 to 50°C (32 to 122°F); RH max 100%	
	Dimensions	145 x 80 x 36 mm (5.7 x 3.1 x 1.4")	
	Weight	230 g (8.1 oz.)	

## Ordering Information

**HI83141** is supplied with HI1230B pH electrode and HI7669AW temperature probe, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), calibration screwdriver, battery, protective case and instructions.

**HI8314** is supplied with HI 1217D pH electrode, HI70004 pH 4.01 buffer solution sachet, HI70007 pH 7.01 buffer solution sachet, HI700601 electrode cleaning solution sachets (2), calibration screwdriver, battery, protective case and instructions.

\* Limits will be reduced to actual sensor limits

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## Educational pH Meters

- Automatic Temperature Compensation (ATC)
- Two-point calibration

Hanna Instruments manufactures meters for all levels of use, from education to research grade. HI8010 and HI8014 are rugged, handheld pH meters specifically designed with ease of use in mind. These affordable meters are ideal for education and field applications.

HI8010 and HI8014 perform pH measurements with manual temperature compensation. HI8014 also performs ORP measurements using the mV range and optional ORP electrode (HI3131B).

Two-point calibration can be performed with trimmers on the front panel. Temperature is manually compensated by using the trimmer.

These rugged, manual pH meters are perfect for teaching students the fundamentals of pH measurement.



### Specifications

	HI8010	HI8014	
pH*	Range	0.00 to 14.00 pH	0.00 to 14.00 pH
	Resolution	0.01 pH	0.01 pH
	Accuracy	±0.01pH	±0.01pH
	Calibration	manual, two point, through trimmers (offset ±1 pH; slope: 85 to 105%)	manual, two point, through trimmers (offset ±1 pH; slope: 85 to 105%)
	Temperature Compensation	manual from 0 to 100°C (32 to 212°F)	manual from 0 to 100°C (32 to 212°F)
mV	Range	-	±1999 mV
	Resolution	-	1 mV
	Accuracy	-	±1 mV
Additional Specifications	pH Electrode	HI1230B PEI body pH electrode with BNC connector and 1 m (3.3') cable (included)	
	Slope/Offset Calibration	from 80 to 105%/±1 pH	
	Input Impedance	10 <sup>12</sup> Ohm	
	Battery Type / Life	9V / approximately 100 hours of continuous use	
	Environment	0 to 50°C (32 to 122°F); RH max 95%	
	Dimensions / Weight	185 x 82 x 53 mm (7.3 x 3.2 x 2.1") / 265 g (9.3 oz.)	
Ordering Information	<b>HI8010</b> and <b>HI8014</b> are supplied with HI1230B pH electrode, calibration screwdriver, battery and instructions.		

\* Limits will be reduced to actual sensor limits

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## pH/mV Precision Simulators

- Simulate pH or ORP sensors to troubleshoot your meter
- Simulate temperature
- Provided with universal BNC connector

HI8427 is designed specifically to simulate pH and ORP electrodes to confirm proper functioning of your meter. Standard pH and mV ranges are selectable with a dial on the front panel and pH can simulate sensor response at temperatures between 0 to 50°C.

Provided with a universal BNC connector, this unit is also a high impedance tester for cable and connector inspection with a leakage sensitivity of  $10^9$  ohm. This unique tester eliminates the need for very expensive MΩ meters.

Sometimes it is difficult to recognize whether a particular malfunction is due to the meter or the electrode. By simply connecting HI931001 to your meter's input socket and turning the dials, pH readings can be simulated from 0 to 14 pH in 0.01 steps. The output signals all correspond to pH values at 25°C.

For the mV range, HI931001 can simulate output from -1000 to +1000 mV in 1 mV steps.



### Specifications

	HI931001	HI8427	
pH*	Range	0.00 to 14.00 pH	0, 2, 4, 7, 10, 12, 14 pH
	Resolution	0.01 pH	-
	Accuracy	±0.01 pH	±0.1 pH
mV	Range	-1000 to 1000 mV	-1900, -350, 350, 1900 mV
	Resolution	1 mV	-
	Accuracy	±1 mV	±5 mV
Additional Specifications	Impedance Test	-	$10^9$ Ohm
	Temperature Compensation	all output values are simulated at 25°C	manual from 0 to 50°C (32 to 122°F)
	Battery Type / Life	9V / approximately 500 hours of use	9V / approximately 100 hours of use
	Weight	320 g (11.3 oz.)	255 g (9.0 oz.)
	Environment	0 to 50°C (32 to 122°F); RH max 95%	0 to 50°C (32 to 122°F); RH max 95%
	Dimensions	185 x 82 x 53 mm (7.3 x 3.2 x 2.1")	185 x 82 x 53 mm (7.3 x 3.2 x 2.1")
	Ordering Information	HI8427 and HI931001 are supplied with HI7858/1 BNC/BNC coaxial cable	

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